POPULAR AVIATION

Including SOUTHERN AVIATION and AERONAUTICS

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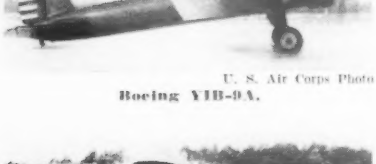
A Progressive History of

by
GORDON S. WILLIAMS

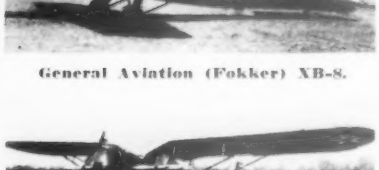
One of the recent Boeing 299 Four engine bombers.

Keystone XB-1 (2-600 Packards).

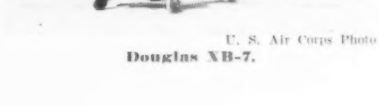


U. S. Air Corps Photo
Boeing YIB-9A.

Boeing XB-9, Model 215.



General Aviation (Fokker) XB-8.



U. S. Air Corps Photo
Douglas XB-7.

THE development of American bombardment aviation from its inception in the crude and slow flying Martin MB-1, produced in the last years of the Great War, to the latest type all metal monoplanes with pursuit-like speeds and maneuverability is a story of dramatic and exciting events.

Though the United States was rather late in entering the field of aerial bombardment it gradually overtook other nations of the world until today this branch of our nation's defense is second to none. The Italian army first used this form of warfare in its attack upon Tripoli in 1912, when crudely made hand-thrown bombs were rained upon the enemy troops.

The World War added great impetus to bombing and saw the development of many large multi-motored ships which were capable of carrying large bomb loads. At this time, however, the U. S. Air Service was approximately three years behind other nations in the development of large bombing craft.

In the first years of the decade, following the War, the Air Service encouraged manufacturers to build better, faster bombers that could fly for longer distances, non-stop, than any abroad. Bombers made by Huff-Daland, Keystone, Gallaudet, Martin, Curtiss, Sikorsky, and others appeared in the later years and soon began to take many records for speed and distance flying.

The advent of the monoplane into bombing aviation put new life into this branch of the Air Corps and heralded a new day for all metal bombers with speeds well over 200 miles per hour and ranges of from 1,000 to 3,000 miles.

Bombardment aviation in this country may be said to have originated in the famous DeHavilland "DH-4B," a modification of the British wartime two-seater. This ship was used in large quantities as a general purpose bomber-observation type, carrying small bombs slung on racks under the wings or a large bomb under the fuselage. As these ships were soon found wholly inadequate for the long range bombing missions, demanded of military aviation, the twin-engined biplane type was tested.

The first thoroughly American bomber was built late in 1918 by Glenn L. Martin and, known as the MB-1, proved such a success that the Air Service ordered a quantity of them to be used jointly by the Army and Navy branches of the Air Service.

An improved type was soon afterwards developed, the MB-2, which was in constant use as a standard bombing type up to and including the period in which the Air Service first carried Air Mail across the continent.

The single-engined "Cyclops" XHB-1 (Experimental Heavy Bomber) made by Huff-Daland, was for many years the largest single engined airplane in existence, and although slow and cumbersome it proved itself capable of carrying a large bomb load.

A Packard G2A-2500 engine of 800 horsepower was used driving a huge wooden propeller. This type was later modified into a twin engined machine called the "Super-Cyclops" with a gunners' turret replacing the engine in the nose and with two Liberty 12's mounted on the wings over the landing-gear.

It was then known as the LB-5 (Light Bomber). Other "LB" types were made by Huff-Daland and Keystone from LB-5 to LB-14, all basically of the same type, but those from LB-10 on had sweep-back wings replacing the tapered panels used in earlier models.

The one "LB" not manufactured by either of these companies was the XLB-2, a high wing monoplane turned out by Atlantic (Fokker) Aircraft and mounting two air cooled Pratt and Whitney "Hornet" engines. This ship was actually nothing more than a modified Fokker Transport with center engine removed and replaced with a gunner's turret.

The later types of Keystone "LB" types were redesignated as simply "B" or bomber, during the Army's "cleaning up" of designations. The many other types of bombers for specialized work such as NBS (Night Bomber, Short Range), NBL (Night Bomber, Long Range), DB (Day Bomber), NB

the Air Corps Egg Layers

(Night Bomber) and others were dropped from active service at this time as well. The famous Barling NBL-1 bomber triplane which boasted a power unit of six Liberty engines was merely another of the Army's experiments in the search for a perfect service bomber.

The first ship in the new Army "B" class of bombing ships was the Keystone XB-1, a twin engined biplane of equal span and chord. This job used two Packard 2A-1500 engines of 600 horsepower each for power plants and was of all metal internal construction. It had a span of 85 feet, chord of 10 feet, 3 inches, and a length of 58 feet. It was the third ship to be bought under the Army's 5 year program then in effect, the other two being the Fokker XLB-2 and Curtiss Condor B-2 types. It carried 6 machine guns, 2700 pounds of bombs and had a top speed of 110 miles an hour.

At the same time this XB-1 was being tested, another bomber of much the same general design was also being put through its paces at McCook Field, Dayton. This second job, the Curtiss XB-2 Condor, proved to be an excellent bomber and saw active service until 1934.

It is interesting to note that the Condor B-2 bombers procured by the Air Corps were the only standard bombers to be purchased from a company other than Keystone during the years from 1924-29. The B-2 had a top speed of 130 miles per hour, cruised at 104, and landed at 46 miles per hour, which though not considered good performance in these days was very excellent considering the fact that a bomb load of 4,000 pounds was carried.

The Condor B-2 had a wing span of 90 feet, length of 47 feet and tail span of 22 feet. Construction throughout was conventional tubing and fabric type. The engine nacelle, which was mounted atop the lower wing, was elongated in such a manner as to provide for a gunner's cockpit just aft of the wing, and which placement provided an excellent arc of fire to the side and bottom as well as above.

Crew consisted of pilot and co-pilot in one open cockpit, nose gunner-bomber, two rear gunners in nacelle turrets and radio operator in fuselage cabin. This bomber type was developed into the commercial "CO" Condor that saw much service on our airlines.

The various Keystone bombers, from B-3 to B-6, all show much the same outside appearance and much the same performance. They were basically a large biplane having two air cooled engines, swept back wings of high aspect ratio, single vertical tail and crew of 5 men. The B-3 Bomber as the first in the line appeared in 1929.

This ship used two Pratt and Whitney "Hornet R-1690-A" engines of 525 horsepower each and had a top speed of 120 miles an hour, service ceiling of 13,000 feet and carried a bomb load of 2,000 pounds. The B-3A was also of these same specifications, differing only from the B-3 in having different internal arrangements, changes in gas tanks, etc. Sixty-three of the B-3 and B-3A types were delivered to the Air Corps.

U. S. Air Corps Photo

A Keystone LB-7 bomber with two 525 h.p. Hornets.

Keystone's next ship was the YIB-4 Bomber, in most respects an exact duplicate of the B-3 but having 575 horsepower "Hornets" in place of the smaller power plants, and also having a larger vertical fin and a Frise balanced all metal rudder replacing the common overhung balance type.

This job also had a slightly smaller wing than the B-3, having a span of slightly over 74 feet. When put into production as the B-4 and B-4A, the old type overhung balance rudder of metal tube and fabric construction was again used.

The B-4A showed a top speed of 125 miles per hour and a service ceiling of 14,100 feet. Range was 8 hours at cruising speed. Twenty-five of the B-4 and B-4A types were ordered by the Army, the two differing only in internal details.

Wright Cyclone engines were substituted for Pratt and Whitney's in the B-5 and B-5A Keystones and differed from their predecessors basically only in this respect.

The B-6 Keystone marked the last of biplanes in Air Corps bomber service, all later types being monoplane, chiefly of all metal construction. The B-6 and B-6A types had wings slightly larger than earlier models, having approximately 40 square feet more area.

Engines used were the Wright "Cyclone E's" of 575 horsepower. Top

U. S. Air Corps Photo

Curt'ss Condor B-2.

U. S. Air Corps Photo

Keystone B-3A (2 Hornets).

U. S. Air Corps Photo

Keystone XHB-1—"Cyclops."

Martin XB-907 Bomber.

Martin XB-907 Bomber.

speed was 130 miles per hour, and ceiling of 18,000 feet was reached with full load. Thirty-nine of the B-6A types were delivered to the Air Corps and many are still in service, chiefly at Langley Field, Virginia.

The Douglas Aircraft Company of Santa Monica, California, entered the bombing field with a wholly unconventional gull-wing all metal monoplane, the XB-7. This job was a great advance from the slow Keystones and had many interesting construction features. Main among these features was the "gull" type wing of metal internal framework, fabric covered.

Two 600 horsepower Conqueror engines (ungeared) were mounted in the experimental model XB-7, one on either side of the fuselage, and wholly cowled with streamlined nacelles into the rear of which the landing gear folded in retracted flight position. Fuselage structure was of corrugated dural sheet with dural bulkheads and transverse frames, as was the tail.

Bombs racks of exposed type accommodated 4 300-pound bombs, or a larger number of small bombs. A nose gunner-bomber, pilot, and tail gunner constituted the crew.

Top speed was approximately 175 miles an hour. The production type, YIB-7, of which 7 were made, was changed from the experimental model in that it had a smooth skin fuselage and fabric covered movable controls in place of the corrugated dural type used on the earlier type.

Geared Conqueror engines of 600 horsepower were substituted in place of the ungeared engines as well. The YIB-7, or B-7, was identical to the YIO-35 and O-35 with exception of necessary bombing equipment used in the "B" type.

In 1930 General Aviation (Fokker) entered a mid-wing bomber in the competition for service Air Corps bombers. This ship, the XB-8, was of typical Fokker construction, having a tubing fuselage, fabric covered, wooden cantilever wing, and strut braced tail surfaces. However, a retractable landing gear was for the first time used in a Fokker airplane, which improvement greatly increased its speed. Two Conqueror V-1570-C engines of 600 horsepower were so placed that the wing itself almost wholly cowled them.

A Boeing YIB-9A and XP-936 in flight. U. S. Air Corps Photo

Keystone LB-10 Light bomber.

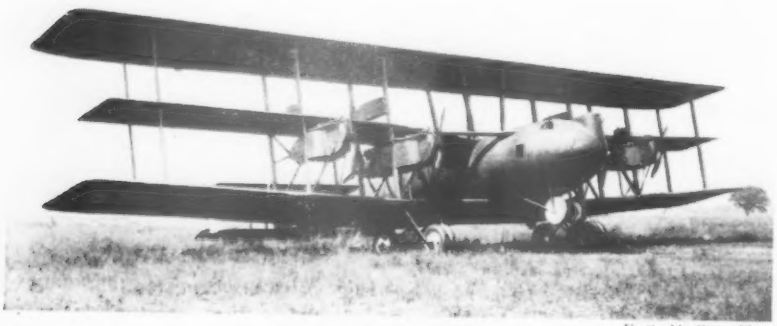
U. S. Air Corps Photo

Huff-Deland XLB-5.

Douglas YIB-7 (2 Conquerors).

U. S. Air Corps Photo

Atlantic XLB-2.



U. S. Air Corps Photo

Barling Bomber NBL-1.

The landing gear folded back into a large well behind the engines. Seven of the YIB-8 type bombers were ordered by the Air Corps and saw considerable service. They differed from the O-27 Observation type only in necessary bombardment equipment. The production type YIB-8 differed from the XB model in having geared Conqueror engines in place of direct drive units and also had a much shorter nose.

Top speed of the YIB-8 was 182 miles per hour and cruising speed was 152 miles an hour. Absolute ceiling was 22,400 feet. Wing span of this job was 64 feet 7 inches, length 47 feet 4 inches, and overall height was 14 feet 6 inches. A disposable load of 2200 pounds could be carried. Three men constituted the crew, with same equipment as the B-7 Douglas.

In 1931 the XB-9 made its appearance, which heralded the dawn of all metal low-wing bombing ships, a type almost wholly used since that time. This ship's performance was considerably better than any former bombing type, and although carrying a crew of 5 men and over 2500 pounds of bombs it had a top speed of 186 miles an hour.

This amazing performance was accomplished with two 575 horsepower Hornet engines. The experimental model, known as Boeing model 215, was tested for some time by Air Corps officials and was found to be an excellent type, and an order for 7 of the types YIB-9 and YIB-9A was given.

The YIB-9 was equipped with two Conqueror GIV-1570 engines of 600 horsepower each and the YIB-9A had as its power plants two Hornet 575 horsepower engines. But one of the Conqueror powered ships was made, however, as the air-cooled type was found far superior in most respects.

The first 4 of the order were equipped with a tail assembly like the XB model, but as a slightly different rudder surface was found to be more effective, the last of the order were equipped with a rounded vertical surface and built-in servo rudder control. This servo control is in effect a small rudder which takes the greatest part of the rudder-bar load from the pilot

(*Continued on page 60*)

Facts Concerning My Racer

by MICHEL DETROYAT

The many discussions that have arisen about Detroyat and his racer are settled once and for all in this article by Michel Detroyat himself, who wrote this article specially for POPULAR AVIATION. Detroyat won both the Greve and Thompson Trophy Races.

CERTAIN people are always looking for sensational news which are not always interpreted as they should by the public at large. I am therefore happy to have the opportu nity, thanks to this article, to be able to set at rest and set aside these errors which sometimes slip into the news.

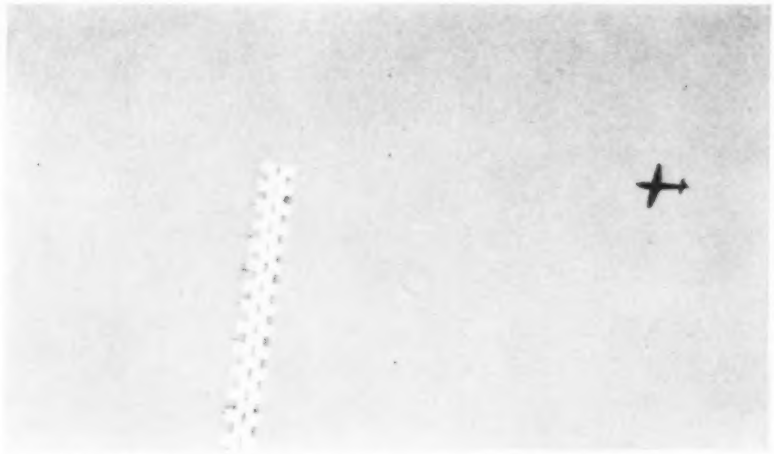
First, it was a question of my trip to America. Indeed, I had the honor to be invited for the third time to the National Air Races in Los Angeles.

My plane, a Morane-Saulnier, with a 400 CV Hispano motor, left Le Havre with my mechanic, Bournat, on the twenty-fifth of July on the Oregon, bound for Los Angeles (by the Panama Canal) where it arrived August 20th. That was one of the reasons why I did not participate in the international stunt flying competition in Berlin since at the time when this competition was taking place for on July 31st my plane was on the high seas.

Luckily, Lieutenant Fleurquin more than adequately filled my place. He is leader of the Etampes patrol and was a worthy representative of the French colors in Germany. Furthermore, he had the advantage of piloting the M.S. 225 with a Gnome motor and Rhone K. 9, the same ship with which I met and conquered the German Fieseler.

This ship enabled me to make a good showing in the world championship flights at Vincennes two years ago. Thanks to this great little machine he should have made the best of his opportunities.

But, to come back to my subject, the organizers of the National Air Races have been asking France for two years to arrange for the participation of a plane suitable for closed course flying. Then came the matter of different courses and special rulings applying to the horsepower to be used on the respective races.



Here is Michel Detroyat and his racing plane passing a pylon in the National Air Races. Note the dart-like aspect of the plane.

A sincere congratulation. Detroyat's mechanic has just kissed the winner of the Greve Trophy race.

The Renault-Caudron, of the same type as the German Meurthe coupe, had made a particularly impressive effect on American officials. The records established by Raymond Delmotte strengthened this impression. This plane, they pointed out, would be the sort that would "come through" in American competition.

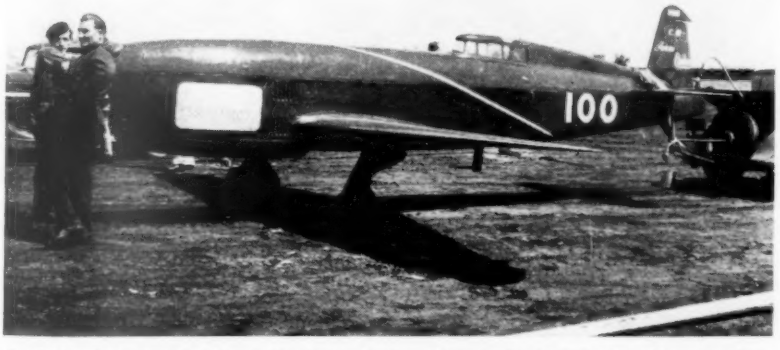
Pierre Cot, our air minister, had decided therefore, that since I had been invited to America with my Morane-Saulnier stunting plane, to make arrangements with the Brequet-Morane firm to allow me to compete with the craft of another company.

On the other hand, the Renault-Caudron people, and principally their chief test pilot, Raymond Delmotte, were in sympathy with all attempts to set a new record, whether their planes accomplished the feat or not.

Delmotte and myself have been on good terms for some time and we were both pleased when they placed at my disposition a German coupe, 1935 model. Their decision to allow a pilot of another company to use one of their craft would not, they said, inconvenience them in any way.

It was not my intention when I left France to try to break the coast-to-coast record held by Howard Hughes. My objective was the Greve Air Race in which the pilot flies against time on a course 100 miles long and in which the aviator is forced to take sharp turns on a closed circuit.

(*Concluded on page* 52)



A photo that clearly shows the long slender lines of Detroyat's speedy monoplane. This demonstrates the superiority of the in-line engine type.

Well, What About the Air Races?

by SWANEE TAYLOR

Playing the part of the "Inquiring Reporter," "The Man in the Street," or what have you, our Mr. Swanee Taylor interviews the spectators on the subject of air shows and aerial acrobatics. Take it away—Swanee!

Here is Mr. F. B. Brown, Los Angeles, who is not enthused by the display of acrobatics, at least as far as everyday utility is concerned. (Hi-Ho)

BY now everything of importance about the National Air Races, held this year at remote Mines Field, Los Angeles, has been read and re-read a dozen times—only to be forgotten with yesterday's newspaper.

Fragile records were perilously created, death and dusty disaster stalked cruelly before the eyes of some quarter of a million Southern Californians and the annual aerial hippodrome plodded along a mite slower than usual to financial triumph. Particularly outstanding, in the whole enterprise, was the new high attained by the management in getting "co-operation" (donations), in exchange for valueless publicity plugs; at audience expense.

The flying, as usual, was superb. Although not nearly as much can be said about the important function of announcing. As a former air show announcer it would be extremely bad taste for me to speak of the announcing. Perhaps, at that, the less said on this point the better. Anyhow, a review of the Races would be as pointless as it would be ineffectual. The production genius of the National Air Races is forever as cold as a clam to constructive criticism. Besides, the audience liked the show, and maybe that, in the long run is what counts.

In the interest of POPULAR AVIATION readers, an "inquiring photographer" went through the stands to find out exactly how the crowd felt about thrills set in juxtaposition to flying in general. The answers are self-explanatory and doubtless will prove of extreme enlightenment to aviation lovers everywhere. They follow below:

Mrs. Frances Seebe, 811 N. Bedford Drive, Beverly Hills, Cal.

"If I had watched Milo Burcham, or the other boys before my trip on the airlines, I wouldn't have been so terrified throughout the entire trip."

L. B. Gray, Towel & Linen Supply, Glendale, Cal.

"Why this stuff helps to educate the public to flying. It absolutely does."

C. W. Hanser, Firestone Tire Age'y, Bakersfield, Cal.

"Oh, these accidents have to happen. The crack-ups only go to show where improvement is necessary. They don't bother me a bit. I'd fly right now if I could."

Mrs. T. E. Newman, Salt Lake City, Utah.

"Why acrobatics show the vast possibilities of the airplane. It's man's mastery of the air. Oh no, accidents don't bother me one bit. I'll fly anytime'"

Refused to give name.

Very testily, "Don't bother me, I'm watching the races."

Beverly Bulah, aged 8, 398 Menlo Ave., Los Angeles, Cal.

Mrs. T. E. Newman, Salt Lake City, Utah, is disturbed by accidents nor would they keep her from flying. (Well, there are different ways of looking at things and this is one of them.)

"It's good for Los Angeles. Ooooo, I hate that noise!"

T. B. Brown, 620 Northwestern Ave., Los Angeles.

"Shut up that guy talking and I'll like it. No I don't want to fly. It won't be safe for another ten or twenty years."

Refused to give name.

A feminine relative said, "You leave him alone, he's excited. And he's got to go out back!"

William Long, 511 Garfield Ave. S., Pasadena, Cal.

"No sir, I wouldn't have ridden in one of those things last week, but I sure would today. I think they are as safe as streetcars."

And so it went, some for racing, some ag'in it and some neutral, or at least guarded in their replies. It might be interesting to pull this poll of votes off in the downtown streets rather than at the races to get a better representation of the "nays."

Mr. No Name, on being queried by Swanee Taylor (right) preferred watching the races to being interviewed—and said so. No score for either side from this entry. (Pass it)

Mr. William Long, Pasadena, Calif., says that the races have converted him to the cause of aviation and safe flying. He thinks that they are as safe as streetcars. (M-m-m-m.)

Mr. C. W. Hauser, Bakersfield, Calif., don't mind a few crack-ups occasionally. They show the pilot and designer where things should be improved. (The trouble is that they show them only once.)

The 1936 National Air Races

by J. H. MEYER

A description of the Races which beside a lot of thrills created enough black headlines to put aviation back at least 6 months. A complete record of results are included.

BEAUTIFUL California weather—the kind you read and hear about—prevailed during the 1936 National Air Races at Los Angeles, and made a brilliant background for the many celebrities who attended this annual aviation event.

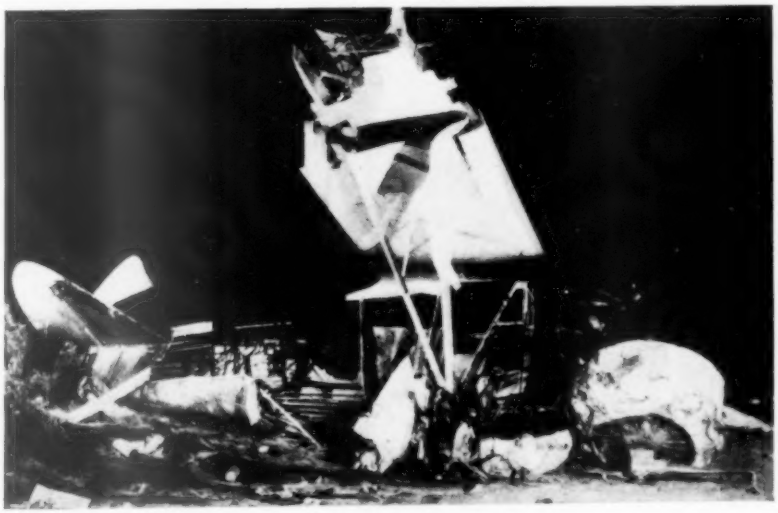
Movie stars turned out in full force to watch the top-notchers in the flying game do their stuff, and the everyday guy was kept busy turning his head skywards, to gasp at aerial thrills that defied all the laws of gravity, and scanning the boxes in search of cinema headliners.

Phil and Cliff Henderson, the two brothers responsible for this annual thriller, were there. They are, perhaps, the only two civilians in the United States who can annually call out the crack air corps divisions of the army, navy and marines. Foreign aces too, flock to these shores at the command of Phil and Cliff, to compete with the leading American birdmen.

The pioneer of women flyers saw the races. She is Matilda M. Moisant, second woman in the United States to have a pilot's license. The number is 44—she still has it. First was her good friend, Harriet Quimby. Member of that distinguished group of old-timers, the Early Birds, she learned to fly at Garden City, Long Island, in 1911. Reason: Her brother back in France, was a flyer, inventor and builder of planes. She holds a record among students—she learned in thirty-one minutes, and always flew solo.

Roger Wolfe Kahn clicked a telegraph key atop the grandstand tower. . . . William "Bill" Enyart, N. A. A. representative, was kept busy checking timing reports handed to him by the twenty-five men, mostly old-time race pilots, who were under his direction. . . . "Pop" Cleveland of the Cleveland Pneumatic Tool Company was chief judge of the rules committee—"Pop" is one of the familiar faces always present at the National Air Races. . . . Ditto Jack Storey, announcer par excellence. How he keeps up his incessant chatter for four days will always remain a mystery.

Col. Roscoe Turner had a spill that spelled disaster for the ship but which did not seriously injure Turner.



The unfortunate crash of "Mr. Mulligan" in which Benny Howard and his wife were both seriously injured. "Mister Mulligan" is a complete washout.

The Texaco crowd was there in full force. They always traveled in a group. "Duke" Jernigan was at the head, followed by Ralph Hall, Aubrey Kieff, "Pete" Claussen and Ralph Hardin. W. A. "Bill" Moores stooge for Mr. B. E. Hull, president of the Texas Pipe Line Company, was there. He flies the gleaming white Waco, flagship of the Texaco planes.

Milo Burcham, member of the International Stunting team, performed breath taking precision stunts at 180 MPH. He enjoys the reputation of being the World's Champion Inverted Flight Pilot. He performs for the Chevrolet Motor Company.

Harold Johnson, who did spins and rolls in a Ford trimotor, was one of the highlights of the show. The seemingly impossible stunts that he does in his Ford caused even the old-timers to shake their heads in wonder.

A brand new thriller added to the program was the act of Don Stevens and Frank Wolcott, who changed from a motorcycle to a glider. The glider was pulled past the grandstands by an automobile, and Don Stevens, riding next to it on his motorcycle, would climb aboard at the right moment. . . . Paul Mantz, Frank Clark and Easton Noble, known as the Hollywood trio premier sky writers, and "said it with smoke."

Captain Dick Granere, Canadian World War Ace, put on his novelty flying act, sponsored by the Chevrolet Company. Dick, attired in his farmer's costume, pretends that he doesn't know how to fly. He climbs into his Curtiss pusher and puts on an excellent comedy stunting act. . . .Faye Lucille Cox

daily presented her famous delayed parachute jump from 10,000 feet.

Three foreign stunt pilots daily thrilled the crowds. Captain Alecandro Papana from Rumania, Gerd Achgelis from Germany and Michel Detroyat, French Ace. The latter was, perhaps, the outstanding performer in the entire show. Winner of the Thompson Trophy Race, he withdrew from the Shell Trophy race to give, as he puts it, "Someone else a chance to win." Americans should feel a trifle apologetic towards this gesture of good sportsmanship on the part of Michel Detroyat. It was made after Roscoe Turner criticized him for possessing such a fast plane that it prevented any American entrant from winning. Colonel Roscoe Turner might have been among them but for a fateful crack-up in New Mexico that made him a spectator in the grandstands with two broken ribs. Earl Ortman flew a beautiful race in the Thompson Trophy, and placed second.

For the first time in history the women walked off with the honors in the classic Bendix Derby. The flyers, competing for $15,000 prize money, took off from Floyd Bennett field. Mrs. Louise Thaden of Wichita, Kansas, with Miss Blanche Noyes, of Los Angeles as her co-pilot, were the winners in a Beachcraft plane powered by a 420 h.p. Wright engine.

Joe Jacobson of Kansas City, was flying solo in this race when his plane blew up en route. Finding himself suddenly in mid-air he pulled the rip-cord on his plane and floated safely to earth. Tough luck dogged his steps when he cracked-up in landing after the Greve Trophy Race in the plane built by Benny Howard. He escaped injuries in both cases.

Everyone felt badly about the accident that put Benny Howard and his attractive wife Maxine, who was acting as co-pilot, in a hospital in New Mexico. Flying his speedy Mr. Mulligan, one blade of the metal propeller was hurled from its socket by the tremendous centrifugal force of the whirling shaft. The resulting lurch of the unbalanced engine shook the hurtling craft from tail to nose, throwing it completely out of control.

Harold Neumann, Kansas City transport pilot, took a bus-man's holiday from his daily routine of flying giant TWA skyliners and won the stellar Shell trophy race. His 223.204 mile per hour clip brought him $2400 and a 1000 new record bonus. Art Chester, Glenview, Illinois speed mechant in a home-made ship traveled 222.235 m.p.h. for $1500 prize. Brown-eyed, diminutive Betty Browning of Kansas City, won the Amelia Earhart race,—second and third place went to Gladys O'Donnell.

Jack Storey was busy calling celebrities to the "mike" to say a few words. Jimmie James, of Western Air Express, greeted the crowd. In ten years of operation his company has not killed or injured a passenger. It is a safety rec-

(*Continued on page 69*)

Condensed Tabulation of the Races

BENDIX TROPHY RACE

TRANSCONTINENTAL FREE-FOR-ALL—UNLIMITED—TOTAL PURSE $15,000 00

Event No. 1

Place	*Pilot*	*Home Port*	*Entrant*	*Make of Plane*	*Engine*	*Elapsed Time*	*Prize*
1	Louise Thaden	Bontonville, Ark.	Louise Thaden	Beechcraft	Wright	14:55:01	$7,000.00
2	Laura Ingalls	Burbank, Calif.	Laura Ingalls	Lockheed	P&W Wasp	15:39:38	2,500.00
3	M. Gulick	.....	.....	Vultee	Wright	15:45:25	1,500.00
4	George Pomeroy	New York City	.....	Douglass	Wright	16:16:51	1,000.00
5	Amelia Earhart	New York City	Amelia Earhart	Lockheed	.....	16:34:53	500.00

AMELIA EARHART TROPHY RACE—WOMEN'S A. T. C. HANDICAP—TOTAL PURSE $1,500.00

Open to Motors of 800 cu. in. Displacement or Less

Event No. 3

Place	*Pilot*	*Home Port*	*Entrant*	*Make of Plane*	*Engine*	*Total Elapsed Time*
1	Betty Browning	Wichita, Kan.	Cessna Aircraft	Cessna	Warner SS	15:58:62
2	Gladys O'Donnell	Los Angeles, Calif.	Gladys O'Donnell	Ryan	Menasco	16:10:01
3	Genevieve Savage	Coronada, Calif.	Genevieve Savage	Ryan	Menasco	16:27 25
4	Jeannette Lempke	Bay City, Mich.	Jeanette Lempke	Davis	Warner	16:30·94
5	Nancy Love	Boston, Mass.	Nancy Love	Beechcraft	Jacobs L-4	16:44:06
6	Henrietta Sumner	Los Angeles, Calif.	Henrietta Sumner	Cessna	Warner	16:44:58
7	Edna Gardner	New Orleans, La.	Edna Gardner	Porterfield	Warner	16:47:29
8	Melba Beard	Altadena, Calif.	Melba Beard	Porterfield	LaBond	16:53:03

SHELL TROPHY RACE—FREE-FOR-ALL—TOTAL PURSE $6,000.00

Open to Motors of 375 cu. in. Displacement or Less

Event No. 4

Place	*Race No.*	*Plane No.*	*Make of Plane*	*Engine*	*Cu. In. Displ.*	*Entrant*	*Pilot*	*Home Port*	*Avg. Spd M.P.H.*
1	1	NR283Y	Folkerts	Menasco	363	Harold Neumann	Harold Neumann	Kansas City, Mo.	223.201#
2	3	NR12930	Chester Special	Menasco	363	Airplane Sales Corp. of Chicago	Art Chester	Glenview, Ill.	222.235
3	4	NR225Y	Miles & Atwood Special	Menasco	363	Leon A. Atwood	Lee Miles	Wichita, Kan.	202.848
4	37		Howard	Wright Gypsy		Joe Jacobsen	Joe Jacobsen	Kansas City, Mo.	147.424*

*NOTE: Joe Jacobsen was awarded fourth place at the end of fifteen laps, there being no other planes left in the race.

#NOTE: The speed of the winner estab lishes a new National Air Race record for planes in this class. Pilot Neumann, therefore, received in addition to the first place purse of $2,400.00 the $1,000.00 award for establishment of a new speed mark for this class.

SHELL AWARD—FREE-FOR-ALL—TOTAL PURSE $3,000.00

Open to Motors of 375 cu. in. Displacement or Less

Event No. 6

Place	*Race No.*	*Plane No.*	*Make of Plane*	*Engine*	*Cu. In. Displ.*	*Entrant*	*Pilot*	*Home Port*	*Average Speed*	*Prize Money*
1	1	NR283Y	Folkerts	Menasco	363	Harold Neumann	Harold Neumann	Kansas City, Mo.	231.344	$1,350
2	3	NR12930	Chester Sp.	Menasco	363	Airplane Sales Corp. of Chicago	Art Chester	Glenview, Ill.	230.479	750
3	37		Howard	Wright Gypsy		Ben O. Howard	Joe Jacobsen	Kansas City, Mo.	147.565	450

LOUIS W. GREVE TROPHY RACE—FREE-FOR-ALL—TOTAL PURSE $10,000.00

Open to Motors of 550 cu. in. Displacement or Less

Event No. 7

Place	*Race No.*	*Plane No.*	*Make of Plane*	*Engine*	*Cu. In. Displ.*	*Entrant*	*Pilot*	*Home Port*	*Average Speed*
1	100	C6406909	Caudron-Renault	Renault	488	Michel Detroyat	Michel Detroyat	Paris, France	*247.300
2	1	NR283Y	Folkerts	Menasco	363	Harold Neumann	Harold Neumann	Kansas City, Mo.	225.853
3	3	NR12930	Chester Sp.	Menasco	363	Airplane Sales Corp. of Chicago	Art Chester	Glenview, Ill.	224.682
4	131	NR-51Y	Kling Rider	Menasco	544	R. A. Kling	R. A. Kling	Lemont, Ill.	215.331
5	38	NR-55Y	Howard DGA4	Menasco	489	Ben C. Howard	Joe Jacobsen	Kansas City, Mo.	214.426
6	70	NR261Y	Rider Racer	Menasco	488	Homer T. Seale	Roger Don Rae	Stockton, N. J.	212.325
7	33	NC255Y	Brown B2	Menasco	544	Ernest Schoedsack	Marion McKeen	Inglewood, Calif.	204.475

THOMPSON TROPHY RACE—FREE-FOR-ALL—TOTAL PURSE $20,000.00

Open to All—Unlimited

Event No. 10

Place	*Race No.*	*Plane No.*	*Make of Plane*	*Engine*	*Entrant*	*Pilot*	*Home Port*	*Prize Money*
1	100	C6406909	Caudron-Renault	Renault	Michel Detroyat	Michel Detroyat	Paris, France	$9,500
2	54	NR14215	Rider	Wasp, Sr.	H. W. Marcoux	Earl Ortman	Los Angeles, Calif.	4,375
3	70	NR261Y	Rider Racer	Menasco	Homer T. Seale	Roger Don Rae	Alhambra, Calif.	2,450
4	1	NR283Y	Folkerts	Menasco	Harold Neumann	Harold Neumann	Kansas City, Mo.	1,575
5	33	NC225Y	Brown B2	Menasco	Ernest Schoedsack	Marion McKeen	Inglewood, Calif.	1,225
6	52	R260Y	Crosby	Menasco	Harry Crosby	Harry Crosby	Glendale, Calif.	875

Jump—and You May be a Graduate

by MERRILL E. DeLONGE

An interesting and authentic article dealing with the parachute division of the U. S. Army Air Corps and the methods of instruction.

A TRIMOTORED plane roars overhead in a cloudless sky at an altitude of 1,500 feet. Because of its characteristic markings it can be easily identified as an army plane.

Suddenly a man leaps from the gaping door . . . then another . . . a third . . . a fourth . . . and a fifth! In rapid-fire succession they hurtle from the plant with the speed and precision of freshly printed papers sliding from grinding presses. One after another they catapault into the thin air until eight of them have gone through that cabin door.

Thirty seconds later, eight parachutes spot the blue sky, noiselessly carrying their slowly oscillating riders to the checkered earth below; riders who, in this unusual manner, have graduated from the Army Air Corps parachute training school at Chanute Field, Illinois.

To the country folk who live in this locality, the sight of billowy white chutes spotting the sky is no longer a strange sight. It has become an institution. In fact, if they might have been interested enough to record the number of jumps in one year the total would probably surprise them. It would come to around three hundred.

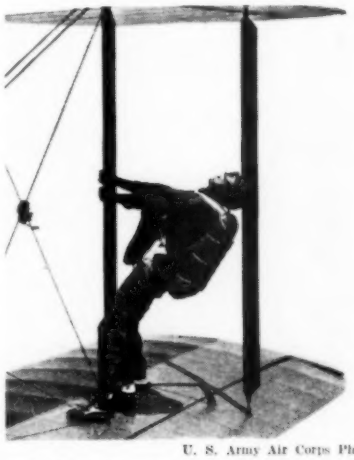
Here is a school where just putting the answers on the examination papers is not enough. True, that is part of it but the real test comes when each member of the graduating class is required to pack his own chute, go aloft and then "bail out" of a plane, to trust his life to sheer silk and his individual ability to pack it so that it will open properly. Needless to say chutes invariably function without exception. Fortunately, for the student who might find his failing him in this time of dire need, he also carries an auxiliary chute for just such an emergency. It is an army regulation that two parachutes shall be worn on all training jumps which also applies to any other premeditated leaps as well.

It was during the closing days of the World War that the Air Corps adopted the parachute as standard equipment and it is now required that all army personnel shall be equipped with 'chutes while participating in flights in army aircraft. Only in the event of an emergency is this regulation ever violated.

With the adoption of the 'chute one might say that a sort of protective life insurance was put into effect, thereby safeguarding army personnel from such unexpected dilemmas as might arise while in flight. And when one considers that the estimated cost to the government for every pilot who graduates from the Army flying school is $50,000 it is obvious that amazing dividends result. In fact, since the time of its adoption more than 750 members of the Air Corps have been given a longer lease on life by resorting to their 'chutes to land safely after forced leaps from aircraft in distress.

U. S. Army Air Corps Photo

Out of the little door in the trimotor jumps the aspirant for graduation honors with old Mother Earth several thousand feet below.



U. S. Army Air Corps Photo

And here we have a back somersault from the wing.

When the parachute became standard equipment, it was naturally necessary that trained personnel be available to maintain the hundreds of silk "life savers" used by the Air Corps members. Constant attention had to be given to their maintenance so that when the emergency presented itself they could be resorted to with absolute faith in their functioning.

As that often related story goes about the parachute salesman who wound up his high-pressure talk in trying to sell one to a prospective buyer by exclaiming, "And, if it doesn't open, well, just bring it back and get another one!" But the army takes no chances. The 'chute must function; it must be mechanically perfect.

As a result, the Air Corps maintains a separate parachute department, comprised of competent personnel at every station whose sole duty it is to see that all 'chutes are inspected periodically, "drop tested," checked and then repacked. Every chute carries a report card which gives its complete history to every minute detail, thereby precluding any possible oversights that might arise while it is in active service.

Incidentally, there have been very few instances in Air Corps history where a 'chute has failed to function properly and most of these failures have been in cases where they were used at dangerously low altitudes. Besides, the element of human calculation enters into the problem thus allowing a loop-hole for errors in judgment.

Without a doubt, every member of the Air Corps has implicit faith as to the reliability of his 'chute. Such confidence erases any feeling of skepticism and that confidence has become an inherent part of the personnel. They do believe in that bundle of silk which they strap to themselves each time before leaving terra firma as the records of the past years so clearly indicate.

The frequent words of advice invariably imparted by the sergeant in charge of parachute instruction at the Primary flying school to each new class of students clinches this confidence securely. "If you give your 'chute

a chance it will never fail you." And, after all, what he prophecies might be taken as coming from one who knows whereof he speaks . . . for he has already made over 300 training leaps! And, strangely enough, up to the present time, he has never made an emergency jump.

Chanute Field, which is located near Rantoul, Illinois, is the home of the Air Corps parachute training school. It is here that its personnel is sent to receive instruction in this all-important department. Here they are drilled in the maintenance, repairing and packing of the air "life-saver." It is here that they learn the detailed construction of the 'chute; where they pull them apart and carefully repack them under competent instructors for some three months.

Then comes that final day when they literally take their lives in their own hands. No doubt, when this day arrives each member of the class entertains queer thoughts as to the magnitude of this last requirement; a requirement so full of exciting possibilities. "Bailing out" of a plane, to rely solely on a 'chute one has just packed himself is certainly a most fitting climax to such an absorbing course of instruction.

Upon graduation, he is then transferred to one of the various Air Corps stations in the United States, or its territorial possessions; a most important cog in a most exacting department. Some fifteen members graduate with each class from the parachute school.

To those who have made this memorable leap there have probably been some unexpected thrills but the story of one, Private Harold Osborn, Air Corps, who attempted a training leap while attending the school was certainly an experience to send fantastic chills down the spine. In "bailing out" of the plane he pulled the rip-cord too soon. Almost immediately complications began to pile up.

In the wink of an eye, that opening 'chute dragged through the tail surfaces and he came to an abrupt halt! Before he could even realize what had happened he found himself dangling by the shroud lines in a most perilous position —swinging crazily from the tail some 1,500 feet above the earth. Fortunately, the pilot, Lieutenant Deerwester, was able to maintain that precious altitude.

The situation looked bad enough at first, but, as time flew by it really took on a most serious aspect. For forty-five long minutes they circled over the field as rescuing planes attempted to offer assistance. Osborn's reserve 'chute was useless because of his present entanglement. The gas supply was not unlimited. Then fortune smiled on him. He was finally successful in grabbing a knife which had been skillfully lowered to him from a plane hovering a few feet above. It took him but an instant to cut himself loose. He fell free. For the second time he pulled a rip-cord to land safely. Most likely he was made class valedictorian without any balloting!

(*Concluded on page* 54)

The Seversky P-35 Army Pursuit Plane

by BURTON KEMP

(See Front Cover)

Showing the Clean Lines of the Seversky P-35 U. S. Army Air Corps Pursuit Plane.

A COMPETITION was recently held at Wright Field, Dayton, Ohio, by the Army Air Corps for planes of the pursuit type.

Four of the leading military manufacturers in this country, Curtiss, Consolidated, Vought & Seversky, submitted designs, and after thorough testing, the Seversky Corp. was awarded a contract for 77 planes, which are designated as the P-35. Parts equivalent to eight additional planes were also contracted for, at a total cost of $1,636,250; this puts the price at $19,250 for each plane.

The Seversky P-35 is somewhat similar to the Seversky BT-8, 30 of which are being delivered to the Air Corps. It is an all-metal ship of low-wing design and is equipped with a very clean single-strut retractable landing gear and a sliding cockpit enclosure.

Streamline tires are used and these project out a short distance from the wing, when in retracted position, so that a safe landing may be made even though the gear should stick in its retracted position.

The sliding canopy over the cockpit not only adds to the speed of the plane, but also protects the pilot from bad weather and makes him more comfortable in the low temperatures at the high altitudes where pursuit planes are employed. The plane is small, but only as small as a pursuit plane can be and still be suited to perform its duties.

The P-35 is powered with a Pratt and Whitney Twin Wasp, 1,000 horsepower; it is known to be more than the 830 developed by the commercial version of the Twin Wasp, as the engine used here has had more time to be developed and improved. It is covered by a full cowling, at the rear of which are situated the special adjustable flaps which control engine cooling.

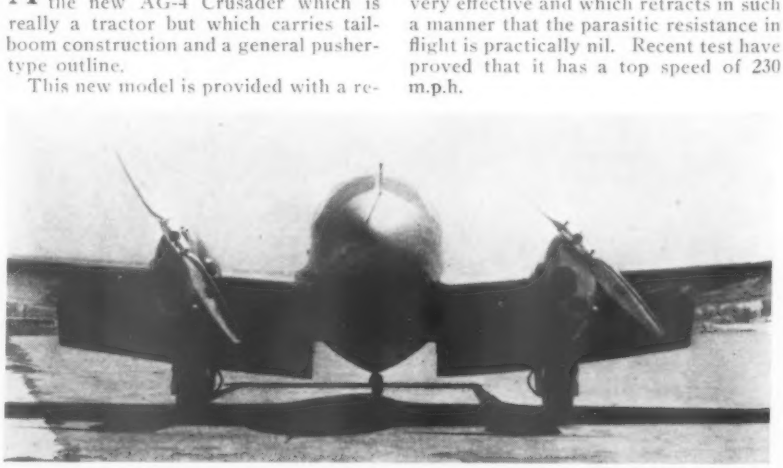
The propeller is one of the new manu-

(*Concluded on page* 52)

The New AG-4 Crusader Bimotor

AND HERE we have a front view of the new AG-4 Crusader which is really a tractor but which carries tail-boom construction and a general pusher-type outline.

This new model is provided with a retractable landing gear that is said to be very effective and which retracts in such a manner that the parasitic resistance in flight is practically nil. Recent test have proved that it has a top speed of 230 m.p.h.



Front elevation of the AG-4 Crusader showing the engine nacelles and with the flaps down.

Chamberlin Plans New Trip

by HELEN S. WATERHOUSE

Our representative found something really worth talking about when she interviewed Clarence Chamberlin, the veteran trans-Atlantic flyer. He is starting on the stratospheric project where Post left it.

"As you know I'm getting ready to fly through the sub-stratosphere to Europe. I would like to say these few things about my trip for 'Popular Aviation.' My idea is to shorten the travelling time across the Atlantic and to prove the feasibiliy of a high speed flight in the sub-stratosphere. If this flight of ours is a success, I predict 12 to 15 hour service between New York and Europe. Mrs. Chamberlin will accompany me."

Signed—CLARENCE CHAMBERLIN

Clarence Chamberlin and his wife are interested in a story dealing with the Curtiss Condor found in a past issue of POPULAR AVIATION.

OUT to conquer the new frontier of the air is Col. Clarence Chamberlin, who is shortly to fly in the no-man's land of the sub-stratosphere to Europe, if his plans work out.

The man who in 1927 flew to Germany with Charles A. Levine as a passenger is bent on writing new aviation history by being the first man ever to conquer that eerie region far above the earth.

"If I do succeed in my goal of flying at an altitude of 35,000 feet above the sea, I hope thus to prove that the place for transoceanic heavier-than-air flying is in the sub-stratosphere," he said recently. "I will prove that flights can be made up there, regardless of what storms are raging down below. The weather at that altitude is always clear and calm and windless."

The flyer revealed that he expects to make the crossing in about six hours, travelling at 400 to 500 miles per hour. The failure of the late Wiley Post to achieve his goal and conquer the stratosphere does not daunt this veteran pilot.

He is, in fact, equipping himself with a rubber flying suit similar to the one Post had constructed in Akron, Ohio, with an oxygen supercharger. He is also toying with the idea of having the ship's cabin sealed and fresh oxygen forced within at earth surface pressure. Yet, since this plan of cabin sealing has never worked out very successfully when tried by French and German pilots, he is inclined to think it unfeasible.

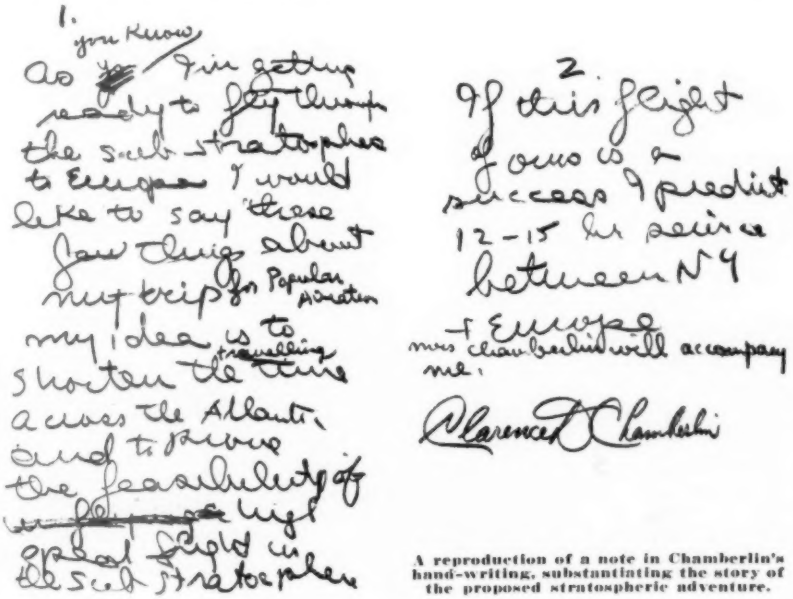
The wing spread of "Miss Stratosphere, She's Tops," the speedy low-winged Lockheed which he has selected for his epoch-making flight is 43 feet. The trim stream-lined ship has a gas storage capacity of 600 gallons. The nose will carry a single high-powered engine, equipped with a supercharger.

A huge propeller, eleven feet in diameter, with three blades to bite the thin air, has been added to the plane. There will be an auxiliary power supply to help get the heavily loaded ship off the ground. Chamberlin even debated the use of rockets for this job, but gave that up as too hazardous.

Intricate navy and army instruments are being carried on the flight. The flyer has had strict orders not to reveal the nature of these instruments to foreign countries. The flight will be made early in October if present plans work out. The engine will not be completed till nearly that time.

Equally confident of the success of the great venture is the flyer's bride, the former Louise Ashby, daughter of Senator George Ashby of Maine. Louise will accompany Clarence on the trip. She terms it their "aerial honeymoon," since they have only been married a few weeks.

The slender youthful-looking blonde, who was formerly air hostess on the Chamberlin "air circus," has firm confidence that their goal will be easily achieved. "I think a wife should share all the perils her husband has to experi-



A reproduction of a note in Chamberlin's hand-writing, substantiating the story of the proposed stratospheric adventure.

ence. I have not the least fear of making this flight," she says.

Mrs. Chamberlin is herself a pilot, and handles the big Curtiss Condors which Clarence flies around the country almost as well as her husband.

"If the flight is a success, we will have more than 50,000 persons in the United States to thank for it," says Chamberlin gratefully. He explains how he started his air circus, with a view to financing his stratosphere hop. "We have carried passengers in more than 30 states in the last year at $1.00 apiece," he said.

"Each of these passengers whether he knew it or not, was contributing to our stratosphere hop," he said. "We have used two large Condors, each seating almost 30 persons, a small open ship and Miss Stratosphere on this glorified barnstorming tour, as we sometimes term it." All over the eastern and southern United States, old men and women, babes in arms, and persons who never flew before, have experienced the first thrills of air travel in the Chamberlin ships.

And as for Chamberlin—The world-famous flyer is slightly grayer and more bald than when he startled the world by flying with a passenger to Europe, but he is still the same old adventurer at heart. He is the only one of the Early Birds who is still making plans for long distance flights and outstanding achievements in the air.

He is a "natural flyer" and has the mechanics of aviation down to his finger tips. He works on his own planes with his own hands because he loves to do it. The stunts he does in the air are not for love of being a dare-devil, but simply because he likes the feel of doing new things with his plane.

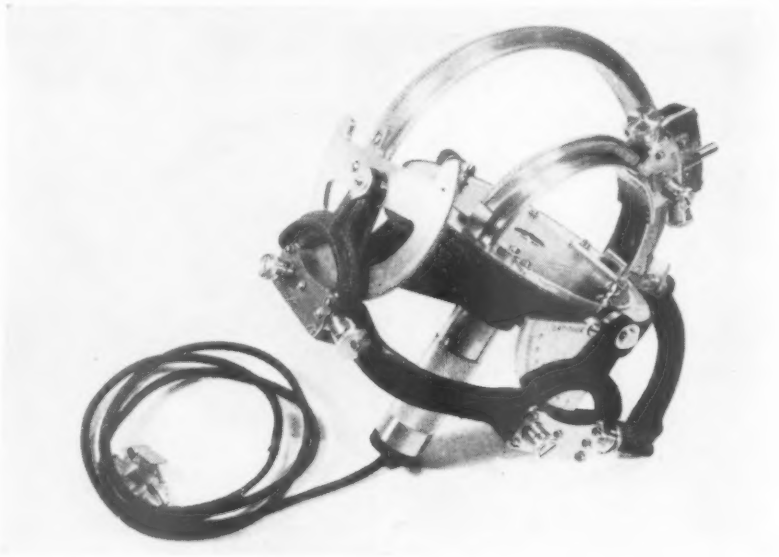
Since the days when he wrote his first school essay on the subject of Aviation, he has been air-minded. The little workshop he had back in Teterboro airport in the old days was but the beginning of his long career as an airman supreme.

So, with a modest, hard working man at the helm and with but one goal in his mind these days, things look pretty rosy for the success of this newest air venture of them all—Chamberlin's sub-stratosphere flight.

END

And then Chamberlin takes another interested study of POPULAR AVIATION.

"Shoots the Sun" Within Two Minutes



This photo shows the complete Hagner Position Finder adapted for air navigation as well as for service at sea.

THE Hagner Position Finder is a new navigation instrument for use in the air, at sea and for a number of operations on the ground. It automatically solves the spherical triangle and, therefore, drastically reduces the likelihood of errors and eliminates the loss of time involved in the complicated computations by conventional methods.

It has been developed by the Fairchild Aerial Camera Corporation.

Because it is possible to secure a "fix" in less than two minutes, compared to the much greater time required with the standard sextant, the Hagner "slide rule" sextant is the most practical sextant ever developed for use in aircraft. Besides its advantages in ocean navigation interesting possibilities are seen in its use by amateur yachtsmen who either have never mastered the conventional sextant or who do not wish to be bothered with the complicated computations that device requires.

The primary purpose of the Hagner Position Finder is to eliminate much of the complicated trigonometric computation necessary in the usual methods of determining a "fix" and in the solution of the spherical triangle.

Its simplicity of operation and accuracy, however, have greatly increased its field of application and it can be used for numerous other purposes besides those mentioned above. Some of its other applications are:

1. Determines a line of position.
2. Determines the angular altitude of any heavenly body.
3. Measures angles between any two heavenly bodies.
4. Locates true North.
5. Corrects compass for both deviation and magnetic declination.
6. Gives initial course.
7. Gives distance in nautical miles between two places in great circle course.
8. Gives angle of artillery fire.

The Hagner Position Finder is a small, compact instrument of high precision, which may be considered a miniature celestial sphere. It consists principally of a horizon plane, declination arc, latitude arc, altitude arc and hour angle circle. The horizon plane carries the altitude arc, azimuth circle and a spherical level bubble.

In the center of the level bubble mounting is located a ⅛-inch diameter circle which is the geometrical center of the instrument and corresponds to the observer's position on the Earth when making an observation on a celestial body. The graduated azimuth circle rotates inside of the horizon circle which, when the instrument is properly set, gives the azimuth of any heavenly body sighted.

The declination arc is graduated in degrees and pivoted at the North and South poles of the finder frame. Thus, when the declination of the observed body is set on this circle, the motion of the body across the heavens can be followed by rotating this arc. By reading the hour angle circle which indicates the angular position, the exact longitude can be determined.

The latitude arc is a part of the horizon plane and is at all times perpendicular to it. When proper settings are made, the exact latitude of the place of observation can be read directly from the graduated arc. At noon when the sun is at the Zenith, the plane of the declination arc and the plane of the latitude arc are the same plane.

The altitude arc is mounted on the

(*Continued on page 63*)

A Noted Aviation Achievement

By ALFRED CELLIER

A graphic description of the massed flight that crossed from England to France during the World War. In view of the primitive equipment, this was truly a marvelous and daring undertaking.

PIONEER aviation's greatest achievement was, without a doubt, the massed flight which crossed from England to France upon the outbreak of the World War. The historical significance of that occasion has generally been forgotten and overlooked as we endeavor to keep pace with later developments.

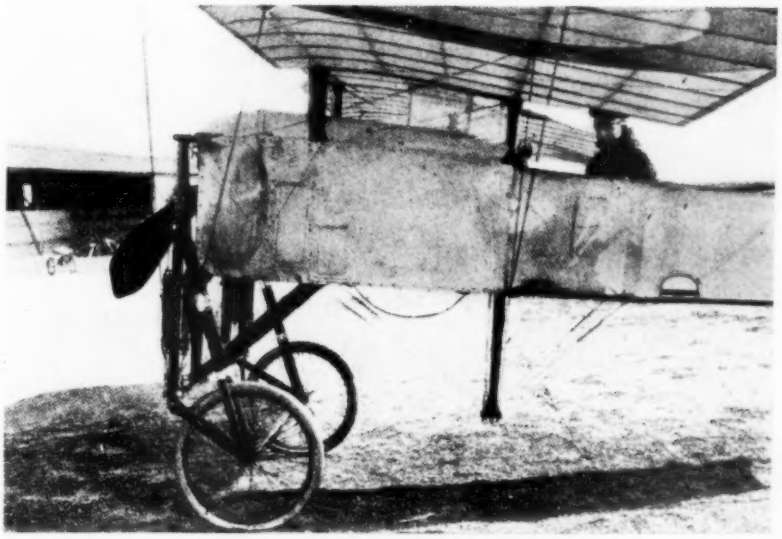
Aviation was then in its infancy, and it is only necessary to look back on the diversity of types of those underpowered and frail machines to realize the great undertaking of that gallant band of airmen who flew them.

For sometime previous to the commencement of hostilities, mobilization plans had been perfected and issued to the tiny Royal Flying Corps. On the day that war was formally declared these plans were carried out. Within a few days Squadrons 2, 3, 4 and 5 had concentrated at Dover, under the command of Brigadier-General Sir David Henderson, in preparation for flying over the English Channel.

The day previous to the crossing saw the flying corps' first casualties of the war. As the preparations were going on and a few straggling machines arrived, Lieutenants R. R. Skene and R. Keith Barlow were killed when their airplane crashed during a bad landing.

With everything set, the flight to France took place at 6:25 a. m. on August 13, 1914, just six days after war was declared. This feat accomplished by 63 airplanes has gone down in history with glorious acclaim.

The first to land on the previously prepared French aerodrome was Lieutenant H. D. Harvey Kelly, who, flying a B.E.2, came down at Amiens at 8:20 a. m. Headquarters of the Royal Flying Corps meanwhile was established at Maubeuge. The last of the units to arrive at Amiens was the Aircraft Park, consisting of 12 officers and 162 men. This organization had brought with them twelve spare airplanes for replacements, eight of which had been flown over with the original units a few days before.



A 1914 Bleriot monoplane, of the high-wing type but with the same form of landing gear used on the earlier cross-channel type.

Of these four combat squadrons that flew to France, Numbers 2 and 4 were completely outfitted with B.E.'s. Number 3 Squadron was made up of some Bleriots and Maurice Farmans, while Number 5 Squadron was composed of Avros, B.E.8's and Henri Farmans. The Aircraft Park had a little of everything. Altogether, the little force that went to France comprised 105 officers and 755 men, the non-flying personnel with the equipment of the squadrons having been transported by boat.

This left the home establishment just about stripped, there remaining 41 officers who were assigned to the three remaining squadrons and staff and school duties. The machines then assigned to the home establishment numbered 116 of various makes.

A standard Bleriot monoplane of 1914, showing the unusual method of mounting the Lewis gun. This is what might be called a "tripod mounting."

As the squadrons were moving from Amiens to Maubeuge, on August 16th, the second casualties occurred when a B.E.8 of Number 3 Squadron, piloted by E. W. C. Perry with H. E. Parfitt as his observer, crashed on the Amiens aerodrome and burned, killing the crew. Just two days later a similar accident took place at Perronne, in which Lieutenant R. R. Smith-Barry and Corporal F. Gerard were killed in the same type of machine.

After arriving at Maubege, the squadrons carried out reconnaissance for the British Army which was then engaged in the start of the Mons battle. Through the efficient scouting of this small force, it was not long before their army found that they owed their existence to the flying corps, as on several occasions the information they brought back prevented them from being trapped and annihilated.

Losses in action were yet to come

and on August 22nd, a machine failed to return from a patrol. This was an Avro two-seater of No. 3 Squadron, with Lieutenants V. Waterfall and C. G. Bayly, who were shot down by rifle fire of German infantry near Fournes. Later that same day, Sergeant-Major Jillings was shot through the leg by enemy fire while observing from a machine of No. 2 Squadron. His wound, likewise was from an infantry rifle.

As the Germans were all the while rapidly advancing, the small British Expeditionary Force was compelled to retreat and headquarters of the Royal Flying Corps fell back to Le Cateau, on August 24th, and in the next two days, to St. Quentin and Le Fere. Eventually, by September 4th, they established themselves on the abandoned French aerodrome at Melum.

During the interim, on August 26th, Lieutenant G. F. Pretyman, with Major L. B. Boyd-Moss as observer, in Bleriot No. 387 of No. 3 Squadron, were shot down from an altitude of three thousand feet by German anti-aircraft artillery. They were "Archies" first victims.

Enemy aircraft, at this time, were rather few and far fetched in the British sector. It was not until the 22nd of August that the first German machine, an Albatros, was sighted. It flew over the Maubege aerodrome apparently endeavoring to learn the strength of the Royal Flying Corps. Several machines took off to give it combat but it soon got away.

Three days after that a German machine of the monoplane type was forced to land within the British lines, while a second was forced down at Le Quesnay. On the 29th, a German airplane made its appearance over the newly established field at Compiegne and dropped three small bombs but they did no damage.

On September 7th, the headquarters of the Royal Flying Corps moved to Touquin, finally locating at Fere-en-Tardenois a week later, where preparations were made for the Aisne battle. The squadrons, in the meantime, changed their aerodrome to Saponay. It was from this base that Lieutenants L. Davis and W. R. Freeman, while on a reconnaissance mission for No. 2 Squadron, were forced to land behind the German lines on account of engine trouble.

A month of active service had passed and it was found that replacements were needed in both machines and personnel. In response to the request for these, five machines—a Bleriot, two B.E.2's, a B.E.8 and an R.E.1—were dispatched with their crews to fill the vacancies. These were followed a few days later by a flight of Maurice Farmans, of No. 4 Squadron, which had remained in England. These latter machines were very welcomed additions, for their type of construction allowed a gunner to sit out in front with a clear arc of fire and they were the only real fighting planes up to that time.

Continuous aerial operations brought on more casualties and on September 22nd, Lieutenant G. W. Mappleback, of No. 4 Squadron, was wounded in the leg when attacked by an enemy Albatros. Although an observer had previously been wounded, Lieutenant Mappleback was the first pilot to be wounded while in the air. It was at this time, also, that Captain L. A. Strange dropped two 20-pound bombs on two converging lines of cavalry at a cross road. This was the first damage ever inflicted by aerial bombs, and it resulted in many casualties and the stampeding of the horses.

By October 12th, it became necessary to move the headquarters of the flying force from Fere-en-Tardenois to St. Omer, and within a week No. 6 Squadron which had been acting as a depot reserve in England flew to Bruges. After operating in that vicinity and covering the retirement from Ostend to Dunkirk, they reported for duty at St. Omer.

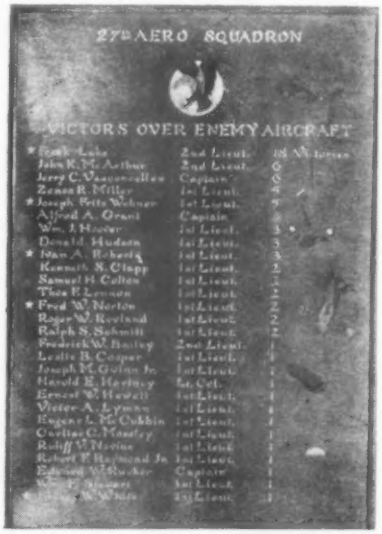
Air combat that had become lax was again engaged in on November 22nd, when Lieutenant F. G. Small and Captain L. A. Strange, of No. 5 Squadron, forced down an Albatros two-seater and took the crew prisoners. It was found that the German machine had been hit twenty times by their bullets.

With 1914 at an end, the Royal Flying Corps had tasted its baptism of fire and had accomplished a great deal of valuable work. There is, however, still more that must be told as regards the massed flight.

(*Concluded on page 64*)

This 1909 Bleriot Type XI monoplane, still in flying condition, is owned by The International Horseless Carriage Corporation, Brooklands Track, Weybridge, England.

A Memorial for the 27th Aero Squadron



The 27th Squadron Memorial Tablet.

ABOVE is the bronze memorial tablet carrying the names of the members of the 27th Aero Squadron who won victories over the enemy.

First and foremost is Frank Luke, the "Balloon buster," who won 18 victories over enemy planes and balloons. Altogether, as the photo shows, this squadron boasted six "aces" with a total of 40 victories. A total of 77 victories is credited to the whole squadron.

Reading up and down the columns, we see such well known pilots names as Eugene McCubbin, Joseph Wehner, Thomas Lannon, etc.

A New Stunt for Seaplanes

AS an ardent fisherman, Alexander P. de Seversky realized that the most helpless man in aviation is a pilot trying to beach or anchor a seaplane alone. So he invented an automatic anchor.

When he dropped down on a secluded lake in the amphibian in which he established a world speed record of 230 miles an hour, Seversky found himself at the mercy of the slightest wind or current, and the whirling propeller prevented his getting to the nose of the pontoons to drop anchor or tie up. Even the largest seaplanes are delicately susceptible to a slight breeze or water movement, so that the pilot usually has to keep his propeller turning to maintain his position.

Seversky's new anchor in its retracted position becomes the rubber or leather-covered bumper on the nose of the pontoon. It is released from the pilot's cockpit and so designed that it digs into the bottom like any marine anchor.

To "up anchor," the pilot taxies slowly over the anchor, lifts it vertically, and reels it back into its nest in the nose of the pontoon. The device may be used on both pontoons of a seaplane, or on the nose of a flying boat.

"....Clear and Unlimited"

Our versatile commentator, in his highly interesting and entertaining manner, makes pertinent remarks concerning doers and doings in aviation.

by SWANEE TAYLOR

National Air Races 1936 . . .

ONE parachute fatality, plus a horrible crack-up the first day insured happy box-office returns. The big winner: Greed & Co. Ltd.—as usual.

Family Feud . . .

In last month's issue of our priceless publication we presented an erudite, though considerably heavy-footed, treatise from the pen of Max Karant entitled, *"The Unbelievable Truth About Hammond's Experimental Plane."* And despite the fact that Max and I are sort of literary kin, I've got to take issue with him on a number of points. Lo and behold, civil war breaks out inside POPULAR AVIATION!

First-off, Maxie's little essay was written in the pompous and somewhat ludicrous, What-are-you-going-to-do-about-it-Mister-President vein, hence is robbed of all its force and impact. Because, this device—whopping editorial indignation—generally is found in bush-league periodicals where the difference between satire and sarcasm remains a vast mystery. Else it sometimes serves, in trade papers, to coddle cranky advertisers or mend fences in quasi-political publications. But not in this magazine, Max. Our readers are quite capable of thinking for themselves, so lay down facts and let it go at that.

Speaking of facts, Maxie, let's get down to them: Just who, sonny boy, are all the big bad wolves so dead set against aeronautical progress? Where are the facts in the case? If you can show me one individual even remotely connected with the Industry who doesn't pray for the day when airplanes will rise like a balloon, fly like a bullet and land like a feather, I'll never write another syllable. And that goes for everybody, too.

You forget, Maxie me lad (or didn't you know), that for years the Industry has been trying to develop a ship suited to the needs and purse of Mr. and Mrs. Everyguy. Ever hear of the Guggenheim Safety Plane Competition with a first prize of $100,000? This one brought forth the Curtiss Tanager, the Doodle Bug, Waldo Waterman's ship and several others.

But, lamentably, they turned out too high in price and too low in performance to suit the market even seven years ago. And right now we have four splendid little ships selling like hot-cakes, which top the Guggenheim entries both in safety (I saw the Tanager crack-up), and performance. Yet they cost less than one-tenth to buy.

You bemoan with lashing bitterness, Max, that, ". . . critics whose entire claim to authority is based on ignorance and prejudice are allowed to voice their chronic condemnations, etc., etc." Well, now speaking of ignorance, whence do you draw your vast supply of *aeronautica?* Not from Gene (Ole Halfback) Vidal, I hope. For there is a one who displays such a rarely achieved lack of practical information that he can be discharged for a lack of evidence. Which may, or may not, be beside the point.

Swanee Taylor, chairman of the anti-Hammond campaign to make America safe for the air-minded, opens his debate with Max Karant of the pro-Hammond camp. Attaboy.

You raise the question of criticism. All right, raise it. But answer me right quick why can't an employer interrogate the motives and methods of his servant —public or otherwise? Don't forget, palsy-walsy, the Bureau of Air Commerce is supposed to be working for us —not we for them.

Another thing you mustn't forget, Max, is that the Industry has a terrific investment to protect. Lots of people in this country invested monies in aeronautical enterprises because they have faith in the men at the heads of these enterprises. Which, according to our American political philosophy, makes it mandatory that said heads speak right up and loud when, why and where they see fit.

Oh, to be sure, I quarrel frequently with individual companies over what I consider smugness on their part. And I think they sorta like me for it. But I've yet to discover a mean, knavish, unmoral or dishonest deed anywhere in our Beloved Industry. Really, they are all pretty swell guys, Max, and you ought to get out and meet some of them.

I simply can't let slide your vicious remarks about present-day airplanes, Max. Here your own lack of knowledge is overshadowed by a mean attitude which ill becomes you, my friend. Or, were you merely striving to put a hyper-dour sock in your writing? That *is*, trade-paper stuff. Anyhow, you ask what the manufacturers of sportplanes do to preserve the lives of their customers; you query, very childishly, if an N.A.C.A. cowling will keep a pilot from bashing out his brains on the instrument panel if he suddenly noses over in landing; then, still in the same paragraph, you pass buck to the manufacturer when a pilot, ". . . errs and stalls close to the ground."

No fooling, Max, that's a lot of billiousness to pack into 14 lines of print. But let's take it apart:

What have the manufacturers done to preserve the lives of their customers? By the gods, sir, they've done this. They have plugged along alone all through the depression—working for starvation wages—turning out better and better ships with each succeeding model until today we have airplanes that are everything but damnfool-proof.

Take a walk through an aircraft factory and you'll get a good idea of the superlative materials and painstaking care that go into each production unit. Then amble over into the engineering rooms and note the air of complete dissatisfaction permeating the place. You'll encounter a lot of frowning young men who've grown old early from worrying how to improve on safety and performance. You think you are scared of a crack-up: That's to laugh! You ought to know something of the gnawing fear that lies forever in the hearts of the men who build them.

Next, will an N.A.C.A. cowling keep, etc., etc.? In the first place, Max, that's a very dumb question. For the simple reason that everybody knows that you don't bash out anything when you nose-over on the ground. There's not enough speed left for bashing purposes once the wheels are on the ground. But since you ask if the cowling is of any help, the answer is yes. It serves as a delightful shock-absorber in such instances, taking up practically all the bump. Thus saving the bottom cylinders and preventing the well-known instrument panel-face for the pilot.

Of course I can think of a manufacturer who likes to chop off another hunk of wing each time he is called upon to

(*Concluded on page* 63)

The Curtiss-Wright 19-R Basic Trainer

The Curtiss-Wright Model 19-R Basic Trainer with cockpit enclosure sealed.

THE Curtiss-Wright Model 19-R Basic Trainer, powered by the Wright Whirlwind engine, is a two-place, low-wing all-metal skin-stressed monoplane.

Incorporated in its design are all the outstanding aerodynamic and structural features developed in recent years for commercial air transport and United States Government military aircraft.

Although it is intended primarily for advanced military training, it can also be equipped as a two-seat fighter by the additional installation of a fixed machine gun synchronized with the motor, a flexible machine gun and bomb racks. Provisions can also be made if desired, for converting the Model 19-R into an attack plane by installing a fixed gun in each landing gear compartment.

Wright Whirlwind engines, ranging from 250 to 420 horsepower, can be interchangeably installed, providing considerable latitude and performance capabilities to fit particular requirements.

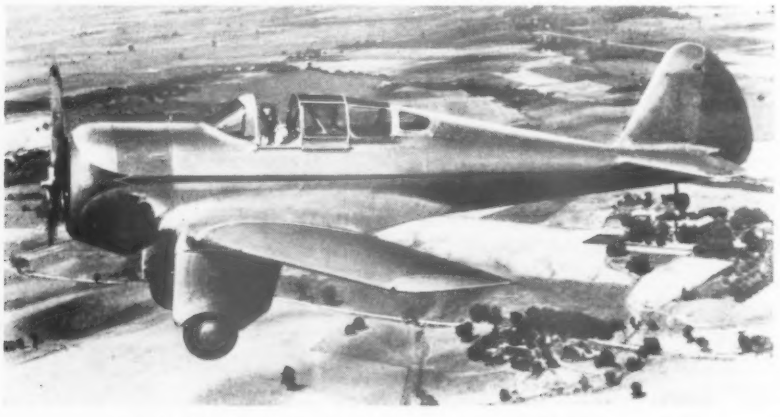
The construction of the airplane consists of cantilever stressed skin, and it is exceptionally rugged and simple. All major loads are carried through the outer shell covering, and all stresses are distributed in such a manner that there is no high concentration of loads. This method of design makes the exterior parts of the airplane the basic structure which can be readily inspected and repaired as required.

The fuselage is of semi-monocoque construction, consisting of Alclad stressed skin with suitable longitudinal stringers at intervals around the surface. Transverse bulkheads and rings complete the shape and supporting structure.

The cockpit enclosure consists of a transparent coupe top, the portion over the front pilot sliding aft and that over the rear pilot sliding forward. Both of these sliding portions of this coupe top may be adjusted in several positions from completely closed to entirely open, making possible varying degrees of ventilation. The firewall which forms the forward bulkhead of the fuselage consists of two metal sheets with asbestos lining between.

The wing is tapered in planform and thickness and employs a special Curtiss-Wright airfoil section which gives an

(*Continued on page* 56)



Curtiss-Wright 19-R with front portion of enclosure opened.

WPA Aids Progress of Aviation

EVERY American community of 100,000 or more persons needs an airport.

Every American community of 100,000 or more persons *can have* a modern, well-equipped airport for less than one-half what they would have had to pay for it five years ago.

With both private and commercial flying—especially the latter—growing steadily, America's "airport plight" really is nothing to be scoffed at. Even the livest of the United States' air-minded states are in need of new or improved flying fields—and now is the time to get them.

The Works Progress Administration has at its command thousands of unskilled laborers. WPA officials, from Washington on down, apparently favor the idea that these WPA workers are an excellent excuse to "do something" about this country's airports. Consequently, the air traveler can cover most of the nation's airlines today and see only a few municipal airports not being improved by WPA workers.

Any *eligible* community is welcome to apply for WPA funds and labor with which to improve or build its airport. Certain qualifications necessarily were made by government officials. Therefore, communities desiring WPA aid on their airports first must submit a detailed chart of the proposed project which finally must be approved by Bureau of Air Commerce officials before work is assigned.

If your community needs and wants an airport, here's what will have to be done to make your project eligible:

First, it must be remembered that the purpose of the Works Progress Administration mainly is to put idle men to work. Hence, that the administration tries to spend as little money as possible on anything other than salaries.

To submit a request for WPA assistance, the applying community first must show that the ground upon which the airport is to be built (taking it for granted the proposed project is a new airport) is publicly owned. WPA assistance is automatically impossible if the airport property is under private ownership of any kind. Communities not having an airport may purchase property for that specific purpose and become eligible.

If the property owned is public, the applying community then must draw up proposed plans for the entire project, specifications, and just how much WPA money and labor will be required. These plans then are submitted to WPA officials who either approve or reject the proposal, depending upon the project's justification. Finally, however, the Bureau of Air Commerce must inspect and approve the project before actual appropriations and assignment of labor can be made.

Expense to the community seeking

(*Continued on page* 69)

The NATIONAL AIR BOARD *Says*— *Unbiased Opinion to Further National Aeronautics*

MEMBERS OF THE BOARD

Richard Aldworth
A. Raymond Brooks
Ray W. Brown
Douglas Campbell
Reed M. Chambers
Richard H. Depew, Jr.
William C. Fleming
Benjamin D. Foulois
Betty Huyler Gillies
Randolph F. Hall
C. S. (Casey) Jones
C. T. Ludington
J. S. McDonnell, Jr.
Augustus Post
Dean C. Smith
Earl R. Southee
James B. Taylor, Jr.
D. W. Tomlinson
William Van Dusen
E. Burke Wilford
R. C. Wood (Paris)

Alexander Klemin, Chairman

AT its fourth monthly meeting, the Air Board had the great pleasure of welcoming a new member, Mrs. Betty Huyler Gillies. Mrs. Gillies is a noted and experienced pilot, of widely recognized good judgment. Her views will be of value to the Board in general topics, and indispensable in matters relating to women in aviation.

Another matter for gratification is the large number of letters received from readers of POPULAR AVIATION. Arrangements are being made for appropriate consideration of and reply to such letters, and for their invariable presentation to the Board.

WHAT SHOULD NATIONAL POLICY BE IN REGARD TO LARGE AIRSHIPS?

The first topic of discussion arose from a statement recently made by Admiral William H. Standley, Acting Secretary of the Navy.* As a result of the Durand Report and of the splendid trips of the Hindenburg, the Navy is preparing certain recommendations for lighter-than-air craft to be presented before the next budget.

There was a lively exchange of opposing opinions.

Surely what one country can do another could. In German hands the airship appears highly safe. German officers and crews are perfectly trained. Dr. Eckener and Captain Lehmann do not attempt to fight storms; they avoid them by skillful weather forecasting and navigation.

The tragic accidents to the Shenandoah, the Akron and the Macon were not so much a matter of structural failure, as of defects in operating knowledge, of semi-political influences. Give our fine naval officers opportunities for adequate training, swallow our pride and call the German experts in as instructors, and the American airship situation would improve marvelously.

There was little doubt in the minds of those present that airships had great possibilities in long range scouting. The large airship, said Mr. Post, should not be compared with airplanes but with surface vessels, and one airship was equivalent to at least three cruisers in scouting power.

Captain Depew thought that the crux of the matter lay in the defensive power of the airship. A dive bomber, with its tremendous speed, its ever growing accuracy in attack would swoop down from an altitude of 10,000 feet and smash such a beautiful target as a large airship to smithereens in an instant.

To this there came the instant rejoinder that the airship could carry its own defensive fleet of fighting airplanes, and could outsail any aircraft carriers housing the enemy's attack planes.

Mrs. Gillies made her first contribution to the deliberations by discussing the passenger transport work of the Hindenburg. No passengers were as yet carried by the Clippers in the Pacific, and it would be many months, perhaps years, before the cautious and wise Pan American Airways would invite passengers to fly across the Pacific. Meanwhile the Hindenburg had reduced passenger flying across the North Atlantic to a matter of routine. One of Mrs. Gillies's friends had crossed from Lakehurst to Friedrichshafen and had found the voyage not only safe, but uneventful even boring.

THE members of the National Air Board discussed a great number of subjects at the fourth monthly meeting, but the most noteworthy subject was the use of lighter-than-air craft in transatlantic flying.

Second, came the matter of suitable locations for transatlantic airports in the territory surrounding New York City. It should be understood that this is more than a local issue because transatlantic routes will eventually affect all of the United States.

That New York City should be selected as the terminus is debatable, but there is no doubt but what every effort will be made toward consolidating the transatlantic airport as well as the seaport at the same city.

In the words of the popular song "They saw the sea," and there was but very limited promenade space and few amusements. The same friend returned on the Normandie. True it took a day or two longer, but what a wonderful time the Normandie had provided to all on board! In this experience there was undoubtedly a forcible argument against the use of the airship in passenger transportation.

No definite recommendations were arrived at as could hardly be expected in a subject of such extent and complexity. There was however a definite concensus of opinion. Lighter-than-air had too many vital national implications to be carelessly abandoned. But the Navy should, before making its recommendations, consider policy most carefully.

Not only should the Navy study the Durand report which covered the technical and structural aspects of the matter, but it should also go into the question of defense against hostile planes; the utility of the airship in scouting as flying boats increased their range; the question whether one or two large craft should be built at once, or whether we should "grow up" by building a fleet of smaller and less expensive craft, etc., etc.

The Chairman was also instructed to write to Commander Rosendahl and solicit from him a statement regarding the defensive power of the airship, this statement to be presented at the next meeting of the Board if possible.

A WORTHY AIRPORT FOR NEW YORK CITY

There are definite indications that Pan American and the British Imperial Airways will soon be operating a joint transatlantic service. Some reports are that the Northern Route will be employed via Newfoundland. But more probably the Southern route via the Bermudas and the Azores will be adopted.

Then there arises the question of where the American terminus will be located. Four cities are fighting hard for this signal honor: Charleston, Baltimore, Newark and New York City.

New York City lost definitely to Newark in the transcontinental services. Will it lose out again, in spite of the fact that the major part of the transatlantic traffic will originate or end in New York?

Somewhat better climatic conditions are rightly claimed for Charleston and to a lesser degree for Baltimore. But what an anti-climax to a voyage across the ocean in a larger and better version of the Clippers, to be 700 miles away

from one's final destination! And surely, as Earl R. Southee pointed out, the Clippers are just as capable of flying into the New York area as the Douglas or Boeing transports.

Granted that this argument is correct, the fight would resolve itself into one between New York and Newark.

The likelihood is that New York City will lose in the final contest.

Why? First because New York has far less local pride and will do less for the airways, make less of an effort than the smaller and more air-minded city of Newark. Second, because New York City has spent vast sums on Floyd Bennett Field and will not eat humble pie and confess to an error of judgment, although Floyd Bennett is totally unsuited for flying boat service. In Jamaica Bay the tides and varying depths of water would be most disconcerting, to put it mildly. A new bridge across the inlet serves to bottle up the bay.

If only New York City would get "wise to itself" to put it into the vernacular, it has in North Beach airport a marvelous opportunity to establish a seaplane and landplane terminal with a magnificent future. With the construction of the Triborough Bridge, North Beach is now readily accessible to all parts of the city—twenty minutes at most to Grand Central.

There is plenty of adjoining land which can be purchased—if the millions sunk into Floyd Bennett are forgotten. Between Rikers Island and the North Beach shore there is a splendid, wide unfrequented channel which could be closed off to surface vessels without the least injury to water traffic and would be an absolutely ideal maneuvering area for the Clippers.

The Board was fortunate in conducting its discussion with practical fliers at the table, who had flown over, surveyed and landed at all these under varying weather conditions, had no axe to grind and no political position to maintain.

A well based and well defined resolution emerged from the discussion:

If New York City would forget Floyd Bennett Field, make amends for its error of judgment, put out a real effort in a worthy cause and concentrate on improving North Beach intensively by land and extending its scope by water, the city would finally achieve something to be proud of and retrieve its checkered airport history of the past.

HOW SHOULD ROADABLE AIRCRAFT BE LICENSED?

Randolph F. Hall of the Air Board could not be present but propounded the puzzling query: How should the Roadable Autogiro be licensed?

The Board did not answer this question. Its opinion was that it did not matter at all whether such aircraft were licensed as automobiles, airplanes, or what you will. What was far more important to determine is whether roadable aircraft were a possibility or a phantastic dream.

Of course, certain far-fetched notions must be completely discounted. Newspaper writers have gone so far as to imagine a type of craft which would permit the driver when in a traffic jam on the ground to start a propeller and fly off into the air! Such a proceeding would be too much of a miracle.

But the Pitcairn Roadable Autogiro is passing its tests. Rene Tampier as far back as 1922 flew a fairly conventional biplane which afterwards navigated the streets of Paris, with wings folded back, in perfect comfort. It proceeded backwards to the amusement of onlookers, but that was a small point. Captain Depew himself flew an airplane at the time of an aviation show in 1928, landed, folded back the wings and drove through traffic to the armory where the show was on. So it can be done.

The difficulties are that every addi-

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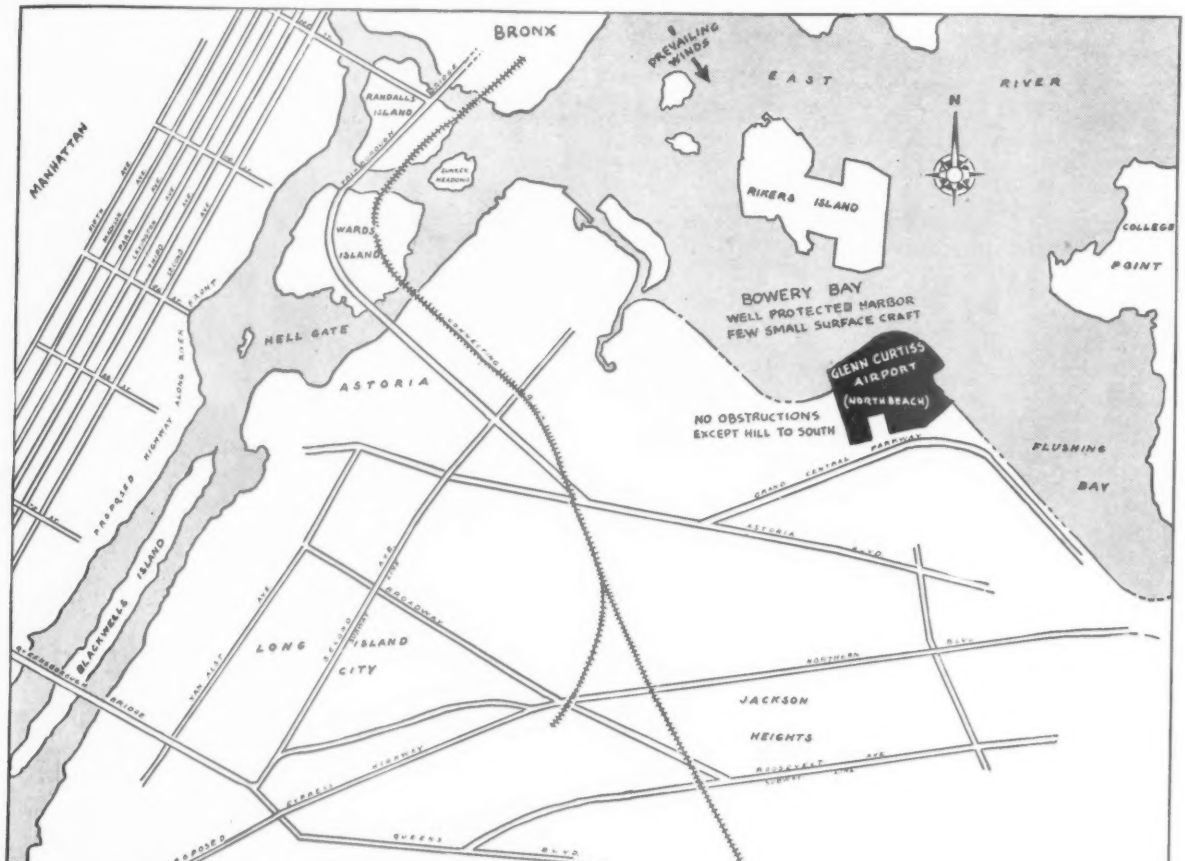


This map illustrates the ideal adaptability of Glenn Curtiss airport for transatlantic flying.

More Gates Air Circus Antics

by JOSEPH R. JAMES

The writer, a stunt pilot with the original Gates Air Circus, conducts you on a little trip to the past when barnstormers were real men and pilots.

ANY kind of a circus dislikes rain. Because circuses are played before crowds and crowds certainly won't pay to get wet. But in those late fall days of 1927, rain for the Gates Flying Circus was like an amateur tenor whining Tosti's "Goodbye."

We were stuck in Ithaca, New York, and it was cold and rainy. But even though the Cornell boys had a good football team that year, it meant little to us because we wanted to fly.

The crimson circus planes were tied down and covered as well as possible to protect them from mother Nature in one of her worst moods and when she was acting up like this, she was a depressing visitor indeed to the barnstormers.

Usually the pilots ended up the way of all active males—playing a stiff game of stud poker in the local hotel. The mechs and roustabouts, never with more than the price of a hamburger in their pockets, would watch us mournfully, and then decide to explore the town thoroughly. This consisted of tramping single file in and out of every store without making a single purchase. If they did come back with something curiously unsuited to a Gates mechanic, we never asked them how they got it. We left that to the heirs of the five-and-dime stores to find out.

It rained for a whole week and, long before it stopped, the members of the Circus were getting dizzy from squatting on the ground so long. Schedules had to be revised, dates cut and not only did it hurt us financially, but it cast a reflection on the reliability of the whole outfit which made our chief, Clyde Pangborn, not too happy. Pang was certainly a stickler when it came to keeping to schedules.

When the rain finally stopped and the low leaden clouds were broken up by a stiff northwester, we caught glimpses of the sun and a few blue holes that showed us the sky was actually there. But, by morning, the wind had increased to such a velocity that even walking was uncomfortable.

When the outfit reached the field, the old crates were straining at the tie-down ropes, almost ready to pull out the stakes that had been loosened by a week's downpour. The mechs made a concerted dive, with additional ropes, to keep the ships from taking off like a kid's paper kite.

We all stuck around waiting for the wind to subside because we were booked in Olean, New York, that morning and here it was noon with at least a forty-mile gale to buck. The old Standards rarely could fly over 75 miles per hour on the level and wide open.

By three o'clock, everyone's patience was completely exhausted, Roy Ahearn's and Lee Mason's, particularly. These two giddy birds proceeded to untie and warm up their crates for a take-off, while Pangborn sat by to see the outcome of their foolishness. Against his best judgment he had reluctantly consented to the pleadings of his two impatient flyers.

Old Jenny pokes her nose out for recognition.

With their engines finally warmed and a mech on each wing to help them get into position for a take-off without being turned over on their backs while taxying, they gave their crates full gun, taking off in twenty feet and going straight up like a couple of heliocopters. After reaching a thousand feet, still directly over the spot from where they took off, they decided to turn and circle the field while waiting for the others to follow.

By the time they completed their turn, however, they realized, much to their dismay, that the force of the wind at their altitude was considerably greater than the speed of their old crates and that they were being blown away from the field in spite of their wide open motors. The problem before them now was how to get back on the field.

Both kept climbing in spite of themselves, and after reaching some three thousand feet, they nosed their ships down into a power dive and just barely made the field. As soon as the crates touched the ground, mechs and roustabouts pounced upon them to hold them down.

Their combined efforts and wide open Hisso motors held the ships from being blown away while they were being hurriedly tied down again to solid earth where they remained over night. Naturally, this meant more cancellations, more unlucky poker and more useless trinkets brought back by the disreputable raiders.

That night it was decided that this state of affairs could not continue and that we would leave in the morning no matter what happened. Johnny Runger immediately left for Olean in the big Lincoln staff car and Nick Gungler followed in the red supply truck. Over night the wind had died down and in the morning the country side was covered with a blanket of light fog.

This condition is quite common at that time of the year in the Finger Lake region, so it was not until afternoon that the pilots took off. The visibility was less than half a mile and it was necessary to fly quite close to the ground to avoid losing sight of it. Within fifteen miles of Olean, the fog became thicker and all the pilots except Pangborn decided to land before they crashed into something.

Pangborn, after landing at the Olean field, was surprised and somewhat worried about the absence of the rest of his birds. After waiting some fifteen minutes, straining his ears for the welcome sound of a motor, he concluded that they all must have landed somewhere and took off in search.

He soon found McKinney and, in an adjoining cow pasture, his two other crates were parked with the pilots helplessly sitting in their cockpits waiting for the fog to clear up. How Clyde managed to find them in all that pea-soup was beyond me. After circling over them, Pang cut his motor and yelled down for them to follow him. Once more the indomitable courage and skill of this fearless pilot brought safety to his little brood of red wings. At times, it seemed that Pang was endowed with psychic powers in his ability to locate himself in fogs.

We only had a two-day stand at Olean because the passenger line was thin and the pickings small. We were plenty

XUM

glad to pull out and hop for Johnstown, Pennsylvania, but nobody knew what tragedy lay in wait, because we were too happy to be on the move again.

In Johnstown, the deadliest blow of all fell upon the outfit. The Department of Air Commerce grounded the whole Circus! Nobody could actually believe it. The famous Gates Flying Circus, crack pilots and daredevils all, forced to the ground! We argued and stormed and pleaded, and after many hours of this kind of attack, Lee Mason and Pangborn were permitted to fly but without passengers. The funny thing about it all was that Mason's ship was the worst one in the outfit.

After the government inspectors left the field, McKinney and Ahearn filled up their tanks and took off late in the afternoon for the home port at Teterboro, New Jersey. The distance was only three hundred miles by air, but the boys forgot that late October days were short and long before they expected it, darkness caught up with them.

They were still over one hundred miles from their field, and caught in complete darkness in a ship entirely unequipped for night flying was no pleasant situation. It becomes so dark that you can't see your compass or any other instruments, while the occasional lights on the ground seem like lightning bugs. The direction of flight becomes uncertain and if you consider the worry of rapidly diminishing gas, the neat little problem of making a forced landing in total darkness among unfamiliar territory confronts the lucky pilot.

Well, McKinney's Liberty Curtiss R, being slightly faster than Roy's Standard, was soon lost in the darkness ahead and it was little wonder that Roy was soon lost, staying in the air only as long as his meagre gas supply held him up. Soon this was exhausted and down came Roy in pitch darkness, his propeller still, only the flying wires screaching their song of impending disaster.

In a few seconds, Roy and his crate brushed a tree top, another hooked his left wing, he was swung into another and ship and pilot slithered down to the ground in a patch of woods. Roy came through unhurt with his usual miraculous luck, and since it was beyond any hope to salvage the ship he left it to rest in peace, knowing there would be little left to salvage this time.

Ives McKinney, with his big Liberty motor snorting flame out of all twelve cylinders, kept the old crate on a compass course for Teterboro and when it got dark, fished out a small flashlight to take an occasional glance at the board and make sure he was still holding the proper course.

It was blacker than an alley cat and Mack started a mental computation of elapsed time in the air and his gas supply. If he was not bucking a headwind he decided he should be able to make the field just before his fuel gave out. But these were minor worries for Mack. His mind had room for two others, a

(*Continued on page 66*)

Man Made Tornadoes Threaten Aviation

by SELBY MAXWELL

The beginning of the vortex above the hot clear gases of the oil fire. Note the curl in the cloud at the upper left.

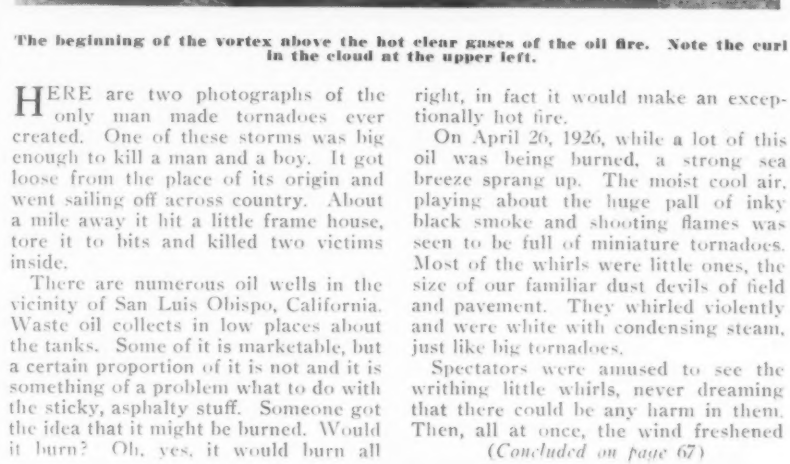
HERE are two photographs of the only man made tornadoes ever created. One of these storms was big enough to kill a man and a boy. It got loose from the place of its origin and went sailing off across country. About a mile away it hit a little frame house, tore it to bits and killed two victims inside.

There are numerous oil wells in the vicinity of San Luis Obispo, California. Waste oil collects in low places about the tanks. Some of it is marketable, but a certain proportion of it is not and it is something of a problem what to do with the sticky, asphalty stuff. Someone got the idea that it might be burned. Would it burn? Oh, yes, it would burn all right, in fact it would make an exceptionally hot fire.

On April 26, 1926, while a lot of this oil was being burned, a strong sea breeze sprang up. The moist cool air, playing about the huge pall of inky black smoke and shooting flames was seen to be full of miniature tornadoes. Most of the whirls were little ones, the size of our familiar dust devils of field and pavement. They whirled violently and were white with condensing steam, just like big tornadoes.

Spectators were amused to see the writhing little whirls, never dreaming that there could be any harm in them. Then, all at once, the wind freshened

(*Concluded on page 67*)



The tornado is now nearly fully developed and is beginning to move away from the fire on its tour of destruction. Note the funnel directly over the fire.

An Engine for Cannon Planes

by ERNEST NAGY, Jr.

The modern revival of the cannon plane brings forth many interesting points in engine design. The large bore cannon shoots through the propeller hub and special provision must be made for this mounting.

THE high speeds attained by recent bombers demand still higher speeds from the fighters.

Top speeds of new fighter types of Hawker, Supermarine, Loire, Dewoitine, Nieuport, etc., now undergoing flight tests are in the neighborhood of, if not greater, than 300 m.p.h. This speed does not permit the usual fighter tactics and recent discussions upon this theme show that the high speed fighters can make only short attacks on bombers, consisting of power-dives and straight flight without turns.

Hence, the period during which the pilot can use his machine guns is limited to 3-4 seconds only. The only existing method of coping with the problem is to improve the range and efficiency of fighter armament.

This is made possible by use of heavier armament so that the pilot can start firing within a distance of 800-1,000 metres from the enemy, thus prolonging the firing period to 8-10 seconds. But the heavier arms induce greater reaction powers, so aircraft having such armament should be specially designed for the increased stresses, augmented by gun reaction.

The Hispano-Suiza company in France, builders of famous aero-engines and cars, has found a solution of the problem, by which it is possible to equip aircraft with this heavier armament without any further constructional modification. Namely: the reaction of gun is absorbed and balanced by the relatively great mass of the engine.

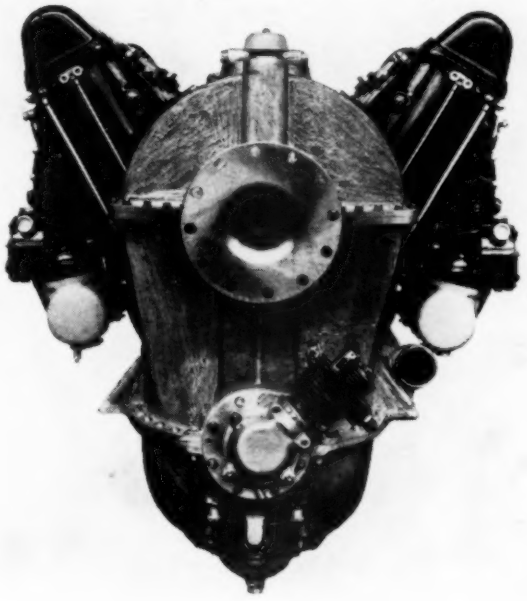
The engine is a normal Hispano-Suiza engine of the "12-Y" or "12-X" type. Its indication is "12 YCrs" or "12 XCrs/12." The number of cylinders is indicated by "Y," the type of same "C," the cannon "r," reduction gear "s"; supercharged.

This engine is a twelve cylinder Vee, liquid-cooled engine. Cylinder blocks are aluminum castings set in two rows in Vee at an angle of 60°. Cylinders are of nitrotured steel. Pistons of special alloy forgings are shorter and lighter than those of previous models.

The disposition of connecting rods is a special feature of the engine invented by Mr. Birkigt, design director of Hispano-Suiza. This offers many advantages from the point of view of lightness, precision and rigidity. Sodium-filled valves are forged, according to a new special process.

The use of high tensile steel for the camshaft makes for exceptional lightness.

The lubrication system is the same as on previous Hispano models. The reduction gear ratio 1:1.5/, consists of only two pinions and offers the great advantage of lifting the axis of traction and so permits the use of an airscrew of greater diameter.



Here we meet the Hispano-Suiza cannon-plane engine face-to-face with the bore of the gun pointing directly at us through the center of the propeller flange. It looks harmless, but . . .

With this type of engine a hollow pinion is employed, as the gun fires through the pinion. The centrifugal compressor, mounted on the rear side of engine, is essentially an electron impeller having radial blades and driven by a speed multiplying gear ratio 10:1. It supplies pure air through two collectors for the six carburetors. Two Scintilla magnetos are fitted.

The 12 YCrs: cylinder bore 150 mm, stroke 170 mm, total swept volume 36 litres. Rated power 860 hp./metric/ at 4,000 m and 2,400 rpm. Take-off power 835 hp. Compression ratio 5.8:1. Specific fuel consumption 260 g/hp.hr., spec. oil cons. 8 g/hp.hr. Min. fuel octane value: 85/C.F.R. motor method/. Dry weight without cannon, but with lafetta: 465 kg.

The 12 XCrs: cylinder bore 130 mm, stroke 170 mm, total swept volume 27 litres. Rated power 690 hp. at 4,500 m and 2,600 rpm. For take-off 660 hp. Compression ratio 5.8:1. Specific fuel consumption 265 g/hp.hr., spec. oil cons. 8 g/hp.hr. Min. fuel octane value 85. Dry weight as above 380 kg.

The cannon is placed between the two cylinder blocks, mounted to the carter and fires through airscrew shaft. So the reaction is damped by the whole motor mass. The cannon is a specially modified Oerlikon FF gun, originally of Swiss design, but manufactured now in France.

CANNON DATA

Calibre 20 mm/0.79 ins./ Total length 2.1 m. Number of grooves :9, depth of same 0.04 mm, angle of same 5. Initial speed 830 m/sec/2,530 ft./sec/ Max., gas pressure 3,200 atm. Range: horizontally 5,000 m, vertically 3,500 m. Firing speed 400/min. Weight of shell 250 g. Weight of barrel with 15 rounds 6.75 kg, with 60 rounds 25 kg. Weight of cannon unloaded 48 kg, loaded 73 kg.

Among other European fighters equipped with this engine are:—

The "Fairey Fantome," a single-seater biplane, adopted by the Belgian Air Force, with a top speed of over 250 mph., armed by this cannon and four machine guns and noted for exceptional maneuverability.

The "Dewoitine" D.510 is a low-wing monoplane and you may find its description in the May issue of P. A. The Dewoitine D 513 is a development of this and has a top speed of 300 mph.

The Morane 227-C and Nieuport 125-C are experimental types.

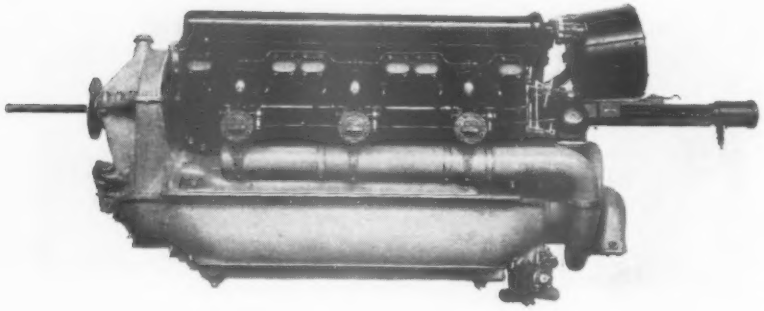
Mureaux 170 is an interesting gull-winged two-seater fighter monoplane with the 12 XCrs engine and top speed of 236 mph. Twin rudders are used.

The Czechoslovakian Avia W.534 is a conventional biplane with enclosed cockpit, top speed of 252 mph. and climbing to 4,000 m in 4.1 min.

Undoubtedly this cannon is at present the heaviest possible and most effective armament we can imagine for single-seater fighters.

During the World War, a number of cannon planes were constructed with hollow shaft firing. One of the most prominent and unusual of these engines was the Italian Bugatti which comprised, in effect, two engines side-by-side with a hollow propeller shaft between them. The Canton-Unne' was a second of these types and the Orpedo was a third of the series.

The Fairey "Fantom," a single-seat fighter adopted by the Belgian Air Force with a top speed of 250 m.p.h., is equipped with the cannon type Hispano-Suiza engine.



A side view of the Hispano-Suiza cannon engine with the breech mechanism at the right.

Issued a "D" Certificate

MORE than 100 airmen wear the wreath-encircled three-gull button, marking the "D" certificate issued for motorless flight. First to acquire his "D" was Wolf Hirth, second Robert Kronfeld and third, Gunther Groenhoff.

There were but six members in 1931 who met the requirements of the flight of five hours' duration with return to the starting point covering a distance of thirty-one miles, and an altitude flight to 3,280 feet above the starting point.

Lieut. Commander Ralph S. Barnaby, Earl Southee, Dr. Wolfgang Klemperer, Richard C. DuPont, Mrs. Warren E. Eaton, R. E. Franklin, J. K. O'Meara, Dr. Karl O. Lange, William Enyart, W. Hawley Bowlus, Donald Hamilton, William L. McGrath, F. K. Izzard, Youston Sekella, Stanley W. Smith, A. C. Haller, Charles H. Gale, A. L. Lawrence and Edward P. Warner are directors of the Soaring Society of America for 1936.

Not So Safe in Europe

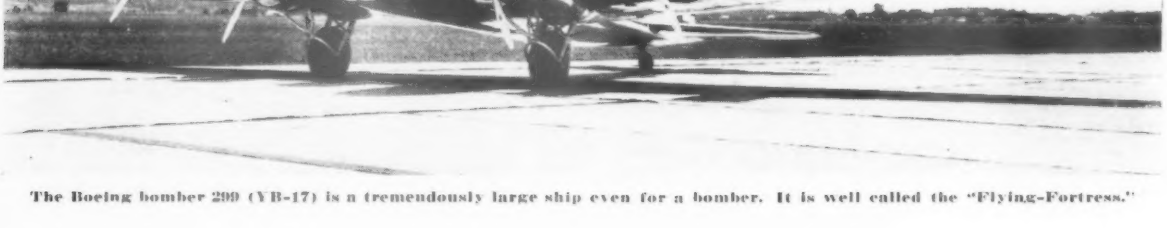
MANY Americans admit quite frankly that their first flight was made while travelling in Europe because it was "so safe." They definitely feel that because of the many automobile fatalities in America, flying too must be more dangerous here. But statistics show that, while American airlines flew a greater passenger mileage than all the foreign lines combined, twice as many passengers were killed on foreign airlines.

This fact and general comparative experience bring an announcement from Aero Insurance Underwriters that they will issue an Employers Aviation Indemnity Policy to persons using American airlines at a rate only two-thirds as high as granted on European lines, and that even this coverage is offered on a very few European airlines.

The First of Fourteen Boeing Flying Fortresses Near Completion

SOON to take its place in the United States Army Air Corps as one of the foremost aerial defense weapons ever devised, the first plane of a fleet of Boeing Model 299 (YB-17) four-engined bombers is nearing completion at the Boeing Aircraft Company, Seattle, Washington. It is powered by the new 1,000 horsepower Wright Cyclone engines.

Except for certain alterations, it will be like the original experimental Boeing 299 which attracted international attention with its remarkable non-stop flight last year from Seattle to Dayton, Ohio.



The Boeing bomber 299 (YB-17) is a tremendously large ship even for a bomber. It is well called the "Flying-Fortress."

The WPA and the Airports

by MAX KARANT

THE depression lull in airport expansion is being gradually obliterated in Illinois today.

Through cooperation of the Works Progress Administration and the Bureau of Air Commerce, air minded Illinoisans are again pushing construction and expansion of air facilities in their efforts to popularize flying and make it safe for the private and commercial aviator alike.

Although outranked by New York and perhaps others in number of planes using its airport facilities, Chicago's public air enthusiasts are out to make that city's municipal airport just four times its present expanse and at the same time provide sorely needed employment to hundreds of the city's needy. And, believing in the same formula are public officials of other leading Illinois cities who are giving Chicago a good battle for comparative supremacy in modern airport achievements.

Believing that new and improved airports will have the same effect on popularizing private flying as the construction of good roads had on the increased use of the automobile, public officials of nearly a dozen Illinois cities have taken the initiative in sponsoring airport construction and modernization projects for execution under the various work relief programs of the Federal government.

This has resulted, under the present WPA program alone, in an airport construction program contemplating the expenditure of approximately $3,000,000 in Federal relief funds to which the city governments and air-minded citizens have added many more thousands of dollars in order to make the projects possible.

And all of the sponsoring groups are agreed on one thing and that is that there are a lot of airplanes flying over Illinois (probably more than any other state) and the only thing needed to bring them down is modern airport facilities. That appears to be the goal and there is much evidence to indicate that a substantial degree of success will be attained in realizing it.

These improvements, according to engineers of the Bureau of Air Commerce, will be the salvation of the air transport industry as well as a major asset to the country's national defense. The Illinois program is but a small phase of the nation-wide airport improvement program now being carried forward under WPA. Bureau of Air Commerce statistics show that of 176 airports in the country now used by scheduled airline operators for passenger and mail service, 106 are now in process of expansion or rehabilitation by WPA workers.

Of the $3,000,000 involved in the state's WPA program for airport im-

(*Concluded on page 70*)

The V-8 Pietenpol Air-Camper Arrives

A side view of the V-8 powered Air-Camper with B. H. Pietenpol in the cockpit.

TO EVERYONE who is or has been associated with lightplane activities in the United States, the name of B. H. Pietenpol of Spring Valley, Minn., is as familiar as the name of Henry Ford to the motorist.

B. H. Pietenpol is one of the very few real lightplane pioneers, his activities dating back to wartimes. And during the many years that have elapsed since that period, he has turned out a tremendous number of lightplanes, lightplane kits and engine conversions. Home-made lightplanes built from his kits can be found all over the country as everyone knows who has followed "What Our Readers Are Building."

The hero of this sketch has always been a Ford engine addict from the beginning and this engine has served as the nucleus around which the many Air-Campers have been designed. He is a firm and unflinching believer in the reliability of converted auto engines and particularly in converted Model "A" Ford engines. He has converted and flown Model "T's," Model "A's," Model "B's" and Model "V-8's."

But of particular interest at the present moment are the photographs received recently from Mr. Pietenpol which show the new V-8 Air-Camper. This is a slick looking little job that carries the characteristic outlines of earlier Air-Campers but which is a side-by-side two-seater instead of the conventional ship.

This two-seater fills a demand for that type of plane by those who are rather wearied of single-seaters. It will be seen that it is still of the parasol type which is simple to build and yet thoroughly stable. Of course, the V-8 Air-Camper is more difficult to build than the four-cylinder type and is correspondingly more expensive, but this need not deter the real fans.

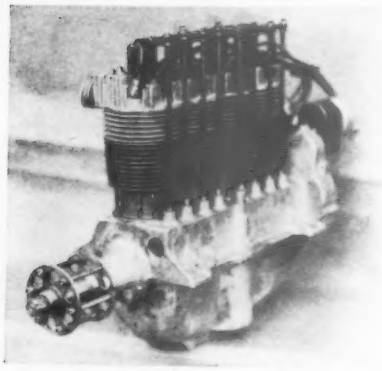
In his letter, Mr. Pietenpol remarks that the size of the radiator will be cut down as the radiator shown in the photos over-cools the engine and does not allow the water to get above 150 degrees. This, of course, is a minor job, but it may improve the performance to some extent.

This first V-8 engined job, according to its designer and builder, handles nicely and flies very well. It is an excellent and economical ship for both dual and solo flight training and yet is large enough to overcome the great difficulty of all super-light planes—the difference in the feel of the controls from those of a large plane.

END

The V-8 Air-Camper from the front showing the radiator arrangement and cowling.

The Hallman B50 Lightplane Engine



Valve rod side of the Hallman lightplane engine showing aircooled cylinders and propeller hub.

THE Hallman B50 Airplane Motor is designed to meet the need for a new lightweight, low cost plane motor.

That this new model meets these exacting requirements, is a result of exhaustive tests and experimentation on various types of built-up and conversion motors. The makers of the Hallman model B50 have incorporated in it the improvements necessary for successful low cost operation of a light plane.

The Hallman B50 motor is distinctly not a conversion type of motor, but is built up of parts found by test to be best adapted to lightweight operating efficiency. In short, it is a motor designed specifically for a light, one or two passenger plane, and is built of parts that are rugged, yet light weight and inexpensive.

The Hallman B50 model Airplane motor develops 50 horsepower at 2000 RPM. Bore is 4 inches. Stroke 4¼. Compression ratio is 4.8 to 1. Dry weight 187 pounds. Displacement: 214 cubic inches.

A feature of the Hallman motor that insures operating efficiency is the improved cooling system which allows air to circulate between cylinders, thereby giving 50% better cooling.

Additional features that increase durability and decrease the weight of the Hallman B50 motor include—close type

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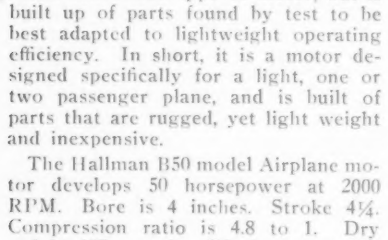


Carbureter side of the Hallman engine.

DISCOVERS A NEW AERIAL DISPLAY

A PHENOMENON of unusual interest to science, and reported for the first time as having been seen from the air, was witnessed by Captain Goodwin T. Weaver, pilot and flight dispatcher for Transcontinental & Western Air, Inc.

Captain Weaver was in command of TWA's Sky Chief (Flight Seven), which had left New York on schedule at 7 p. m. The first landing set for the flight is at Pittsburgh and it was soon after leaving the airport there at 9 p. m. that Captain Weaver noticed the great shafts of white and pale pink which indicated to him he was seeing the Northern Lights.

The lights continued shooting out of the north. The occasional sight of the Northern Lights from an air transport plane is not uncommon, but the display upon this occasion was unusual in that the shafts reached up over and to the south of the airplane's course as it sped westward across the United States.

The lights continued plainly as the plane went on its way. The next and only scheduled landing before reaching Kansas City was made at Indianapolis. Soon after the take off, the shafts of light once more became visible, but it was not until the machine was over Marshall, Missouri, that the outstanding phenomenon occurred.

Marshall was reached at 1:10 a. m., and Captain Weaver noticed that a solid black shadow, in the form of a perfect semi-circle appeared on the northern horizon. It appeared as though a circle of black was being cut in half by the horizon, and the lights were continuing to play, but this time they were shooting, not from the horizon, but from the edge of the great, black semi-circle. The night sky about the black semi-circle was relatively light with stars, leaving the black in bold relief.

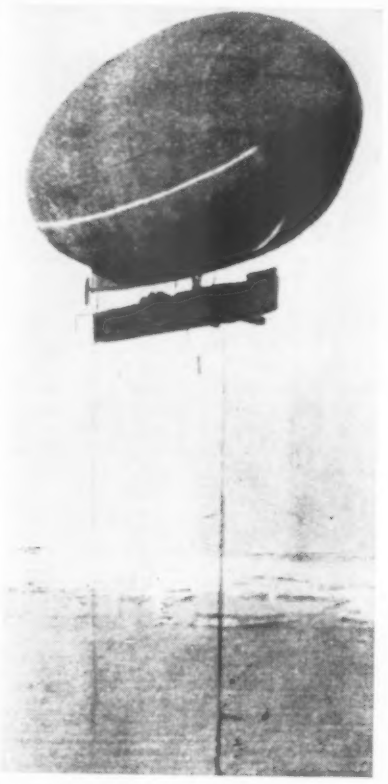
The landing was made at Kansas City and Weaver turned the controls of his plane over to another crew for continuation of the journey to the Pacific coast. Following a few hours sleep, Weaver recalled having read that an eclipse of the sun occurred the night before on the other side of the world. Accordingly he started doing a little checking and this is what he discovered:

Remembering that he was over Marshall at 1:10 a. m., he found that it was 1:10 p. m. at that moment at Kensk, Russia. He discovered, moreover, that Kensk was 180 degrees around the world from Marshall. The next item of interest was in the fact that a solar eclipse just was getting beyond center at Kensk at the very time that he was over Marshall!

Recalling the great, black semi-circle he had seen there, Captain Weaver began wondering whether there might not have been a connection between the eclipse on the other side of the world and the darkened semi-circle he had seen on his side of the world.

Captain Weaver still is looking for the answer.

The First Attempt at a Crossing



Abandoning the "America" in mid-ocean.

TRANSATLANTIC flights, or at least attempts at transatlantic flying, are nothing new, for in 1910 the first actual attempt was made in the dirigible "America" which was commanded by the late Walter Wellman.

This dirigible, although it was designed and built 26 years ago, did not differ greatly in design from the present time non-rigid airships. Its hull was fairly well streamlined while the gondola was of a form that did not present an excessive amount of resistance, probable less in fact than the nacelles of many wartime blimps.

The "America" took off from Atlantic City, N. J., on October 15, 1910, and three days later, after travelling over 1,000 miles, was abandoned by Wellman and the crew. They were taken aboard a cargo steamer, and cast adrift, the "America" was never seen again.

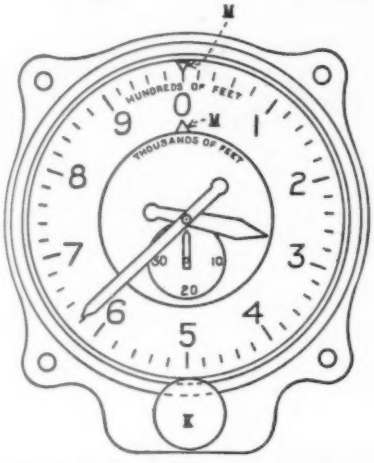
The two ropes seen dropping from the nacelle into the water were the "equilibators" designed for maintaining the ship at a fixed height above the surface of the ocean. If the air let the ship descend slightly, then the ropes were immersed more deeply, the ship was lightened and again regained her original altitude.

If the sun should momentarily warm the gas, giving a climbing tendency, then the weight of the rope (pulled out of the water) would restrain the climb automatically.

Altimeters for Blind-Flying

by S. R. WINTERS

An accurate and concise, yet non-technical description of altimeter construction and application. These instruments are essential to blind-flying and are therefore of particular interest.



Dial of sensitive altimeter in which the knob (K) turns the pointers and the marker points (M). In this view, both the markers (M) are at zero.

RECENT heightened interest in automatic pilots and blind landing of aircraft, combined with the enforced problems associated with fog flying, have attached new significance to the efficiency of instruments for measuring altitude and rate of change in altitude.

In a report to the National Advisory Committee for Aeronautics, Dr. W. G. Brombacher, chief of the Aeronautical Instrument Laboratory in the Bureau of Standards, discloses a thorough study of altitude measurement in blind flying and the instruments necessary for safe and proper navigation under such conditions.

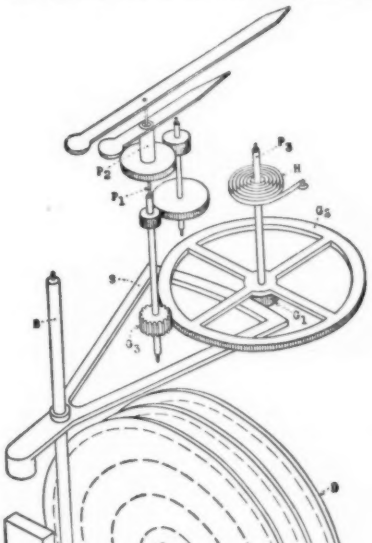
Much of the success attained may be attributed to altimeters that are divided into two main groups: absolute and aneroid. Most of the development work on absolute altimeters has been confined to sonic, radio and capacity types; the aneroid group includes sensitive and barometric altimeters.

Among his conclusions, Dr. Brombacher voices an opinion that the sonic or sound altimeter appears to be the most promising in the absolute classification. The principal defects in its operation at the present stage of development are an excessive weight and bulk, and an intermittent and rather unsatisfactory means of indication.

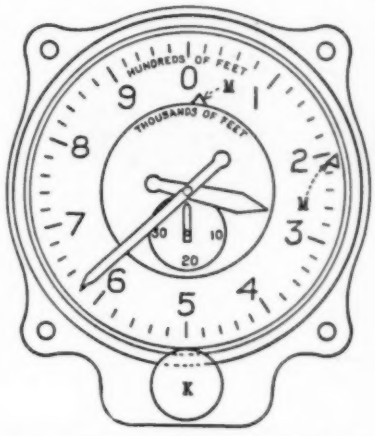
In all its forms the sonic altimeter consists of two essentials: a source of sound and apparatus for measuring the time interval between the emission of a sound and the arrival of an echo from the ground. In one design this time interval is estimated by ear. Since the principal utility is at low altitudes and the velocity of sound is about 1,080 feet per second, time intervals of less than one second must ordinarily be measured. One of the primary difficulties is to avoid interference from the noise of the aircraft engine and propeller.

The Behm sonic altimeter consists essentially of a detonating mechanism for producing the sound, two microphones and megaphones, and a time-interval indicator graduated in altitude units. A gun, automatically fired in the latest design, is used as the source of sound. The time-interval indicator consists of a small flywheel, a projection of which is held pressed against a plate spring by means of an electromagnet and armature.

A sector operated by a pinion on the flywheel shaft, carries a small mirror from which a beam of light from an electric lamp is reflected to a scale. The light is focused by means of a short-focus lens which is supported upon a plate spring which, in turn, is acted upon by an electromagnet. When the gun is fired, current in the electromagnet momentarily is reduced by the action of the sound on the microphone.



A schematic diagram of the Kollsman sensitive altimeter, showing the diaphragm (D) and the interior mechanism. Note the control spring (H) and the arrangement of the coincident pointer shafts (P1) and (P2).



Dial of sensitive altimeter in which the markers (M) have been turned to the new positions from their original zero positions.

This releases the flywheel and thus rotates the mirror.

When the echo is received by the microphone, the electromagnet moves the spring upon which the lens is mounted so that the image of the light on the scale is deflected at right angles to the line of its motion. At the point of oscillation of the light beam the scale is read. The usual range of the instrument is 328 feet and the weight is about twenty-five pounds.

In the earlier model of the General Electric sonic altimeter, the sound from a whistle was directed downward by a megaphone and its echo received by megaphone. At the instant of sound emission, a spring-driven timer was started by means of a solenoid. The indication of this timer was observed at the instant the echo was heard through the stethoscope. In this type of instrument the timer is not ordinarily used at low altitudes and the altitude is based on an estimate by the observer of the interval of time between the sound emission and the echo arrival.

As air compressors were not usually installed on aircraft, gas was bled from the exhaust of an engine cylinder through a check valve and stored at a pressure of about 50 pounds per square inch in the tank. The whistle has a frequency of 3,000 cycles per second and is operated every two seconds.

The bleeder-line increases the strength of the direct signal from the whistle in the stethoscope and the acoustic filter removes low-frequency components due mainly to the engine and propeller. The weight of the instrument was about 30 pounds, and the range was made as great as possible. With the engine run-

XUM

ning at cruising speed, indications up to 800 feet were obtained; with the engine idling, up to 1,400 feet.

Recent modification of the instrument has decreased the range to about 100 feet, which is all that appears to be essential in landing blind. A metal diaphragm periodically operated by electrical means to produce a sound of 3,000 c.p.s., is used instead of the whistle, thus eliminating the bleeding of an engine cylinder.

The sound received after reflection from the earth's surface is passed through a two-stage amplifier. The incident and reflected sounds are transmitted to the radiotelephone in the headgear, giving rise to a sound superimposed upon the radio signals.

The Dubois-Laboureur sonic altimeter has a unique method of indication, which eliminates the use of relays with contacts. At the instant of emission of the sound a neon lamp is lighted by means of a slight addition to the voltage across it. During the time the neon lamp is lighted an electric condenser, the negative side of which is connected to the grid element of a vacuum tube, is being charged. At the instant of reception of the reflected sound a control is operated so that the neon lamp is put out. The maximum change in the plate current, measured by a milliammeter, is an indication of this time-interval and thus of the altitude.

The sound is made automatically at intervals of either two or four seconds by a membrane vibrated by means of compressed air at a frequency of 1,200 c.p.s. The echo is received by an electromagnetic microphone. The instrument has two ranges, 5 to 60 and 20 to 500 meters, the latter of which is obtained by adding a resistance unit to the capacity circuit. The weight of the instrument is stated to be forty pounds, and forty-eight pounds with an air compressor.

A Delsasso sonic altimeter has been developed, which flight measurements show to have a range from 4 to 700 feet but no details are available.

With reference to the two other instruments belonging in the absolute group, namely, radio and capacity altimeters, experiments have revealed them as being of decidedly less importance to aircraft navigation than the sonic type.

Tests involving the radio altimeter indicate that its weight and bulk are too great for general use; also that its altitude limitation is a marked disadvantage. This instrument has been found to function accurately at altitudes beyond 650 feet and has shown no value below 350 feet, a restriction decidedly undesirable to aviation.

The capacity altimeter depends for its indication upon the change with proximity of the ground in the electrical capacitance of two metal plates mounted on the aircraft. The maximum range in indication attained is of the order of 100 feet, which is too low for most purposes.

The chief reason for the development of all absolute altimeters is a need for continuous indication of the altitude above the ground level in making blind landings. This altitude indication is highly desirable, if not absolutely essential and adds much in the way of security.

The second classification, or aneroid type, which includes barometric or sensitive altimeters, is generally relied upon for maintaining a safe altitude above the ground level in blind flying or landing. Particularly in cross-country flying, some form of this instrument is essential, together with a knowledge of the topography of the country flown over.

The use of the aneroid altimeter to measure altitude above the ground level is subject to several inherent disadvantages. First of all, the instrument measures pressure rather than altitude but it is calibrated in altitude units in accordance with the altitude-pressure relation of the standard atmosphere. A given reading, then, corresponds to a definite pressure level and not, in general, to an altitude level.

A second disadvantage is that the altimeter indicates the altitude above a fixed level on the earth, such as sea level, only at the time of take-off. Since the altitude above sea level corresponding to this reference pressure varies with respect to both time and place, this variance produces some degree of uncertainty under unusual conditions.

A third defect of the aneroid altimeter is the barometric method of measuring the absolute altitude above any base depends on measurements of both air pressure and temperature, and on measurements of other quantities which may be neglected here. If the altitude above the ground level is desired, the indications of the altimeter must be corrected for deviation of the temperature of the air column from that assumed in the standard atmosphere used as the altimeter calibration standard. An approximate method of computing this correction, which is sufficiently accurate in most cases, merely involves measuring two air temperatures, one at the ground

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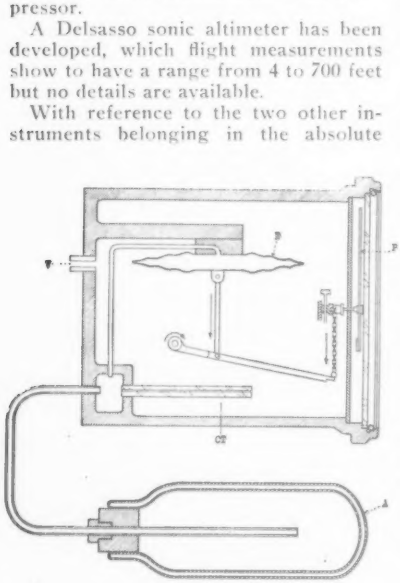
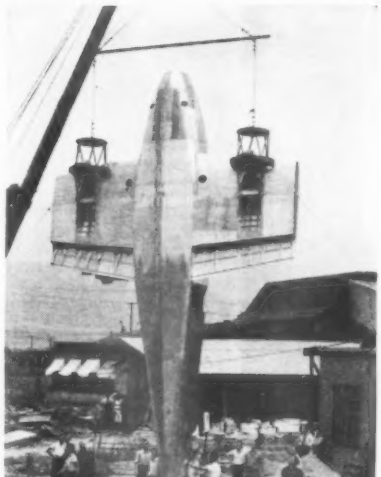


Cross-sectional rate-of-climb indicator with free air vent at (V) and diaphragm (D).

A Lockheed Up in the Air



The Lockheed ascends via ropes, this time.

HERE is an exceptional opportunity of studying the main body and wing-stub assembly of the latest Lockheed. It is hoisted for test in the yard of the manufacturing plant and when in this attitude, displays its enormous size. Note that the wing stubs, including the engine nacelles, are integral with the body unit.

Largest Drop Test Jig

THIS is the 30-foot structural steel drop test jig constructed by the Boeing Aircraft Company, Seattle, Wash., the largest jig of its kind in the world.

It is used for testing the main wheel assembly for the Model 299 four-engined bombers and the tests showed that the wheels will withstand a load of approximately 80 tons.

The drop tester testing a main wheel assembly.

Scheduled Airlines Study the Weather

by ROBERT JOHNSON
Traffic Dept., United Air Lines

The very rapid growth of interest in meteorology, or the study of weather, has spread to the airlines who now employ many observers, trained in weather lore. Mr. Johnson of the United Airlines, tells many interesting facts about these organizations.

UNITED AIR LINES' weather reporting and analysis is conducted in cooperation with the weather reporting and forecasting facilities established by the United States Government along the airway system.

The government facilities consist of weather reporting stations located at fifty-mile intervals. These stations are operated jointly by the Bureau of Air Commerce and the Weather Bureau. Personnel at these stations make a complete weather observation every hour. They then make teletype reports on the state of weather, the ceiling, the visibility, the direction of the wind and its velocity, the temperature, the barometer reading and remarks covering special conditions.

From these reports, which are collected by the Weather Bureau at airports, are made up sector weather maps every three hours. Each divisional bureau at an airport makes up a sector weather map covering its division. Then every six hours each weather bureau makes up a general weather map of the whole country for regional forecasting purposes.

Weather reports are transmitted by teletype to airway radio stations which are located at intervals of approximately every 200 miles. The divisional reports are broadcast once hourly on regular fixed times. In addition, once hourly each airway radio station broadcasts a report on weather conditions prevailing locally.

These reporting stations are normally situated at frequent and strategic points along the airway to give an accurate check on conditions prevailing along the line of flight, but are also situated at important points off the regular airway in order to intercept and report in advance the approach of bad weather from the north or the south.

Off-line weather stations report regularly every three hours on conditions prevailing in their localities. Should special conditions develop these off-line stations make special reports promptly.

These weather stations, on and off the airways, are on duty twenty-four hours a day. Their personnel are trained observers, thoroughly competent, quick, and diagnose weather at every point of observation. In addition to being capable of discharging their regular duties of making periodic observations and reports, they are qualified to recognize abrupt changes in weather, to diagnose them and to report promptly when such changes occur.

As a result, this nationwide network of weather observers constitutes a veritable army protecting the airways from a surprise visit by "Old Man Bad Weather." There is hardly the remotest chance for a storm to invade an airway suddenly without advance warning from the alert eyed observers of the Weather Bureau.

And here is the meteorologist ready to release the sounding balloon by which he determines wind drift and the ceiling. The theodolite is in the foreground.

United Air Lines does not just accept reports from the Weather Bureau and let its weather service go at that. It has developed a far-flung double check-triple check system that has made meteorologists of some 650 pilots, co-pilots, dispatchers and other ground personnel in the company itself. In charge of Weather for United is O. T. Larsen, company meteorologist. Larsen's experience in weather reporting dates back to 1926 when he was associated with the Airways Weather Division in the United States Weather Bureau. In 1929 he left government service to accept a position with United Air Lines, with which company he has been associated ever since.

United Air Lines' weather system revolves about two individuals—the pilot and the dispatcher. No longer, as was once the case, is the pilot the final court of authority when questionable weather requires a decision as to whether or not a flight can be made safely. Time was when the pilot would decide whether or not he would make a flight, regardless of the opinion of ground personnel of the weather.

Today the procedure in United Air Lines requires the appearance of a pilot at the airport one hour before the schedule of the airplane on a regular flight. He immediately applies himself to a study of all available weather reports, including not only the weather maps and sequence reports furnished by the United States Weather Bureau, but fresh up-to-the-minute reports by radio from pilots of planes in flight and also detailed weather logs made up by pilots who have just completed a trip over the division.

Correlating all of this, the pilot gains an accurate mental picture of the weather along the airway he is to fly and by a study of the conditions is able to forecast that weather for the next several hours—or for the period of time required for his flight.

Entirely independent of the pilot the dispatcher at the airport likewise makes a thorough examination of all weather reports and makes his own forecast of the weather which will prevail along the airway and then he and the pilot get together and check their analyses and forecasts. If they are both in agreement they either fly or do not fly the trip.

If the dispatcher feels that the weather is flyable while the pilot does not believe so, the dispatcher cannot order the pilot to take the trip out. On the other hand, however, if a pilot feels that weather is flyable and the dispatcher is convinced the contrary is

true, he cannot prevent the pilot from taking off.

The next step is for the pilot to make a plan of flight, or trip forecast. He fills out a form in detail, giving information as to his analysis of the weather trend, of the exact manner in which he will fly the trip. For instance: on a flight from Chicago to New York he might indicate on his plan that he would fly from Chicago to Toledo at an elevation of 8,000 feet and from Toledo to Cleveland he would climb on top a layer of clouds prevailing in that division. After landing in Cleveland he will resume his flight at 10,000 feet, at which altitude he will maintain flight until he reaches New York.

The pilot's determining of that plan is based on his information on weather conditions and, furthermore, on his purpose of providing as much passenger comfort as possible by seeking out levels where air is smooth. Pilots of United are guided by the following three considerations in the order of their importance: safety, passenger comfort and maintenance of schedules.

He estimates the wind direction and velocity he will encounter at the various points along the airway; he estimates the exact time he will reach his destination, and having done this he and the dispatcher sign this trip forecast, or flight plan. This forecast is then radioed to the point of destination, and in a flight from Chicago to New York it would be radioed to Cleveland, the first stop.

If the officials at Cleveland feel weather conditions are such at the point of destination that the flight should not be made they can radio back and instruct the flight to be delayed until weather improves.

After taking off on regularly scheduled flights pilots are by no means cut off from any further weather information. In the first place, their radios are tuned to receive the hourly weather forecasts broadcast by the Department of Commerce weather stations, and secondly, the local weather broadcasts over the same wave lengths. Furthermore, they are in regular communication with operators of the company ground stations. In fact, once in the air the pilot becomes a meteorologist. At intervals of every thirty minutes he radios up-to-the-minute weather reports, giving the following information:

Location of the plane at the time of the report; altitude of the plane above sea level; extent of cloudiness (within range of the pilot's vision); type of cloudiness when such report will assist in clarifying the weather picture; altitude to the base of the clouds and/or altitude to the top of the cloud formation—altitude given as above sea level; horizontal visibility including report on causes for any restricted visibility; free air temperature; report on roughness of the air; a summary of conditions encountered since the last periodic report was transmitted; special advices which

(*Concluded on page* 71)

The New Seversky Basic Training Plane

The Seversky Basic Training Plane in flight test. It is equipped with a 550 Wasp engine.

THE new Seversky trainer is an improved version of the Seversky BT-8 now being delivered to the Air Corps as a basic training plane, but it incorporates so many novel and different features that it is actually a new plane.

It is powered with a 550-horsepower Wasp, but the engine is "choked" when in use as a trainer, and delivers only 450 horsepower. Two sets of outer wing-panels are provided, and the landing-gear may be either fixed or retractable. Various combinations of these features place the plane in four definite classifications, giving it a wide usefulness in military service.

With the landing-gear fixed and the larger wing panels, the plane has the performance and easy flying characteristics of the primary trainer. With smaller panels and the wheels fixed, it is an improved model of the present Seversky basic trainer, with still better performance in every respect.

Like the BT-8, it will be the fastest training plane ever bought by the Air Corps. With smaller panels and retractable gear, its performance is stepped up into the tactical plane class and becomes an advanced trainer for combat and tactical work.

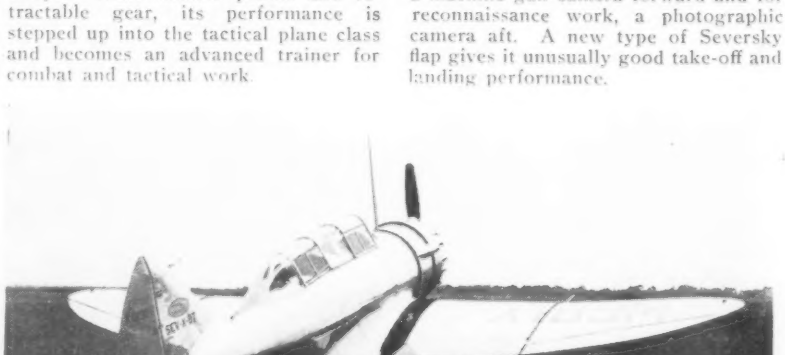
When the full power of the engine is used under these latter conditions, the trainer's performance is equal to that of most pursuit planes in use today.

Its fourth classification is acting as a staff plane for cross-country work. A commodious baggage compartment is included and easy flying characteristics are built in, which make it a comfortable plane for extensive trips.

Both cockpits are fitted with all necessary instruments for training in all kinds of flight, including blind flying and blind landing. Hoods are provided for both cockpits, so that advanced students can cooperate in their blind flying practice on the same flight.

An ingenious device makes it possible to use the same tank with a capacity of 70 gallons or a capacity of 150 gallons, at the will of the pilot and according to the duty to be performed. Accurate capacity reading is possible at all times under either arrangement.

For combat practice, the plane carries a machine gun camera forward and for reconnaissance work, a photographic camera aft. A new type of Seversky flap gives it unusually good take-off and landing performance.



A three-quarter rear view of the Seversky Basic Trainer showing wing and tail-group arrangement.

Some Early Airmail Stamps

by ERIC HILDESHEIM

The author shows some very early "airmail" stamps of great historic value, notably balloon and pigeon mailers devised during the Franco-Prussian War of 1870.

MUCH has been said and written about "The First Air Mail," with several claimants for the honor of flying messages through the breeze. But despite the fact that somebody flew a batch of stamped envelopes from Mineola, Long Island, to somewhere else, back in 1910 or 11. And they had a special "Coronation" air mail flight when the late George V ascended the throne of England. Actual air mail service, however, was already born—since the siege of Paris in 1870.

More to the point, the Parisian *"par balloon monte"* (meaning "manned"), undertaking wasn't a special stunt arranged for the glory of Aviation, King or country. Instead it came of downright necessity when the city was cut off from the world by the Prussian army.

Prior to the siege the French had had the foresight to lay a cable along the bottom of the Seine hoping to keep open a channel of communication while the city held out against the enemy. But this information was betrayed to the Prussians who promptly cut the cable.

So the canny Parisians took a page from Metz, the Alsatian city, which had sent up a few paper balloons, carrying frantic pleas for help, before it surrendered. However, the Parisians organized their Post with typical gallic thoroughness and exactitude. After the first *(non-monte)*, un-manned paper balloons carrying only post cards, they were ready to launch the *par monte*, manned ships.

That the idea was practical is borne out by the fact that during the four months' siege some 65 balloons departed Paris with a total of 238 paid passengers and 12 tons—2,500,000—of letters. And there are still a number of these *par monte* letters to be bought from two dollars up.

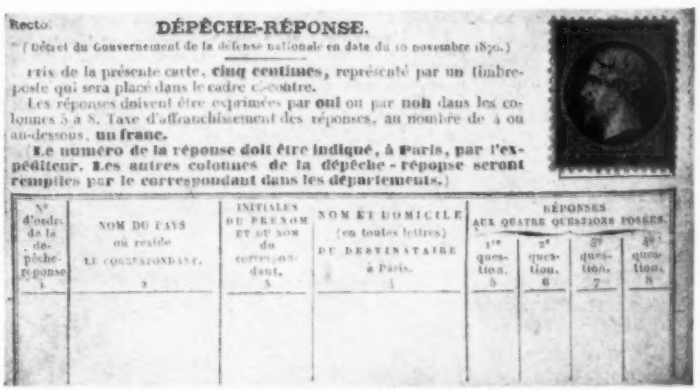
Incidentally, the French government established the first airmail rates to the various countries and managed to make a pretty good profit. A profit was returned because the government limited the weight of each piece of mail to one ounce.

And if the government was wily, so were the citizens. It is a widely accepted fact that your Frenchman has deep wells of resourcefulness which can be tapped to meet most any emergency. Hence many clever schemes popped up to make the very best use possible of the restricted weight allowance. Of course the use of envelopes was out of the question, so the writers resorted to folded stationery of wafer thinness.

Penmanship, too, played an important

Reproductions of the 1870 French Airmail Stamps

A miniature Paris Newspaper mailed in 1870.


Recto:
DÉPÊCHE-RÉPONSE.
(Décret du Gouvernement de la défense nationale en date du 10 novembre 1870.)
Prix de la présente carte, cinq centimes, représenté par un timbre-poste qui sera placé dans le cadre ci-contre.
Les réponses doivent être exprimées par oui ou par non dans les colonnes 5 à 8. Taxe d'affranchissement des réponses, au nombre de 4 ou au-dessous, un franc.
(Le numéro de la réponse doit être indiqué, à Paris, par l'expéditeur. Les autres colonnes de la dépêche-réponse seront remplies par le correspondant dans les départements.)
N° d'ordre de la dépêche-réponse
NOM DU PAYS où réside LE CORRESPONDANT.
INITIALES DU PRÉNOM ET DU NOM du correspondant.
NOM ET DOMICILE (en toutes lettres) DU DESTINATAIRE à Paris.
RÉPONSES AUX QUATRE QUESTIONS POSÉES.
1re question.
2e question.
3e question.
4e question.

An uncancelled airmail postcard of the catechism type.

A typical mailing folder of 1870 for balloon mail.

part in getting one's money's-worth. The number of words various writers managed to set down on the pages is nothing short of astounding. Many writers criss-crossed their lines with—to this day—legible characters.

The emergency also brought the first tabloid newspaper to the world. One enterprising printer featured a combined newspaper and letter sheet which gave the beleaguered ones a chance to send official war news along with their personal messages. Many of these, too, are still within the reach of the average collector.

The problem of getting word back from the outside became more complicated, although it was met with characteristic ingenuity and typical elan. The worthy *messieurs* merely sent out a couple of carrier pigeons with each balloon. These birds were promptly sent to the central post office at Clermont Ferrand for prepared messages already waiting for them.

These "return" messages are probably the most remarkable feature of the whole scheme. All Paris-bound correspondence was set up in type, printed, reduced in size to 1 by 1½ inch, then photographed. Each pigeon carried a tiny film with 16,000 words of news and general correspondence back into the city, where it was projected on a screen and the messages copied and forwarded to the individual addresses. These films, of course, are somewhat rare and great care should be exercised in buying. A number of frauds are offered by unscrupulous traders.

Aviation enthusiasts doubtless are in-

(*Concluded on page 64*)

The central portion of this post card is a newspaper photographed on gelatine which, when enlarged, can be easily read. The gelatine film was rushed by pigeon post.

A Few Random Shots at the Air Races

Quick work by the photographer gives us a view of Joe Jacobson crashing in "Mike."

WANDERING about the field during the National Air Races we found many odd and interesting things in the various nooks and crannies of the ground.

For example, the photographer happened to be Johnny on the spot when Joe Jacobson crashed poor old "Mike" near the pylon but who fortunately escaped serious injury himself. When the shutter snapped, "Mike" was still sliding and raising clouds of dust.

Below, we have a most interesting snap of Capt. Alex Papana, who traveled all the way to Los Angeles from Rumania, via the Air. He flew his ship from Rumania to Germany, transferred it to New York via the Zeppelin "Hindenburg," and then flew to Los Angeles cross-country aided only by an auto map. He arrived in time to participate in the events with other foreign pilots.

Capt. Alex Papana, who traveled entirely by air from Rumania to Los Angeles, is pictured here with his diminutive biplane.

Stress Analysis Made Painless

Graphical Resolution of Forces and Loads

by
RAOUL J. HOFFMAN
Aeronautical Engineer

IN a previous issue we have shown how to find the resultant of two or more forces passing through the same point by constructing a force triangle or force polygon, and that the direction of the resultant is always opposite to the other components (Fig. 1 and Fig. 2). We also have shown that forces which are in equilibrium have their directions, when "going around" the force triangle or force polygon pointing the same way (Fig. 3 and Fig. 4).

These simple graphics cannot be applied to forces that are parallel or to forces not intersecting within the outline of the drawing. To solve such problems—this will include all problems of weights—we add sets of balanced forces which consequently will not modify the result. An example will demonstrate how this addition is effected.

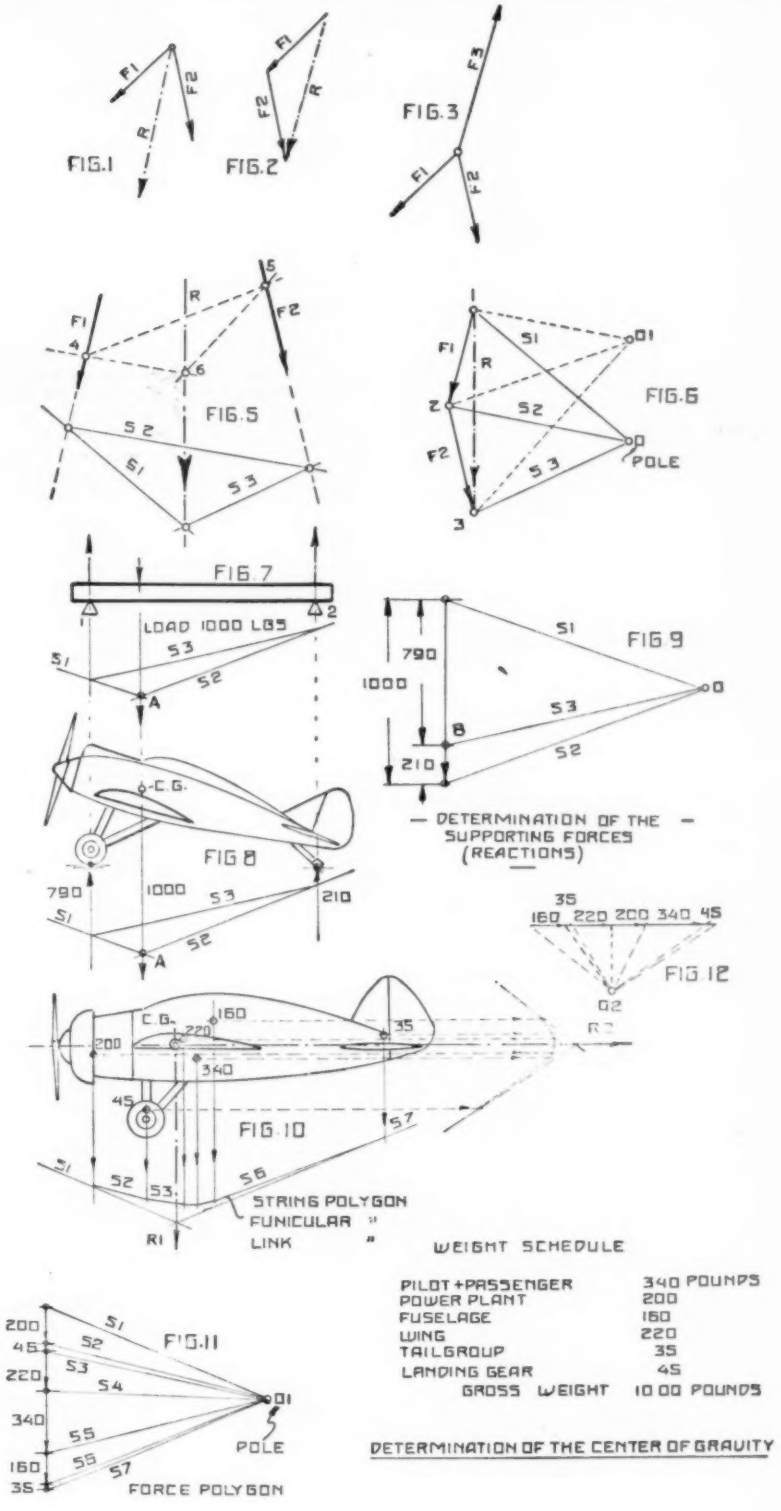
To find the resultant of the forces F1, F2 as shown in Fig. 5, we construct a force triangle by drawing parallels to F1 and F2 from 1 to 2 and from 2 to 3, and connect 1 with 3; the closing line 1-3 will give us the resultant with its magnitude and direction.

But we are not able to locate the resultant in Fig. 5 because the intersecting point of F1 and F2 lies outside the drawing; we therefore select a convenient point O1, called the pole, and connect it with 1, 2, and 3, as shown in dotted lines; then we choose a starting point 4 on F1 (Fig. 5), and draw parallels to 01-1 and to 01-2; the second parallel intersects F2 at the point 5 through which we draw a parallel to 01-3 and extend it to intersect the parallel 1 01-1. Through this intersection point passes the resultant R, parallel to the line 1-3 in Fig. 6.

To demonstrate that any point may be chosen for a pole we locate another point, O, and connect it with 1, 2, and 3; then we draw parallels to same in Fig. 5 shown in solid lines, and find that the intersecting point will be on the resultant R found with the first pole.

It is obvious that by reversing the sequence of operations we are able to resolve a force into two components or are able to find the two supporting forces, which are the reactions that balance the original force.

We have laid out two problems with the same general dimensions. Fig. 7 shows a beam resting on two supports with a single load and Fig. 8 an airplane with its gross weight concentrated at



the center of gravity (c. g.) resting on its front wheels and tail skid.

To find the reactions we draw a force line of 1,000 lbs. to any scale, select a pole 0 and draw lines S1 and S2 (Fig. 9); then we take a point A on the load line (Fig. 7 and Fig. 8) through which we draw parallels to S1 and S2; these two lines intersect the verticals passing through the supports; connecting the intersection points we will get S3. Drawing a parallel to S3 through the pole will intersect the force line at B and divide it into two lengths.

Measuring the two lengths we find that one support will carry 790 lbs. and the other 210 lbs., and that each front wheel will carry 395 lbs. and the tail skid 210 lbs., the machine resting on the ground.

The graphic method of finding the resultant of two forces can be used to determine the resultant of a series of parallel forces. To find the center of gravity of an airplane when the weights and locations of its component parts are given, or estimated for preliminary design, is one of its applications.

To find the c. g. of the whole airplane shown in Fig. 10 with the c. g. of the main items located, we draw a vertical line through each c. g. point and construct the force polygon (Fig. 11) by drawing a vertical on which we mark off each weight in the same order as they are located in Fig. 10. We select a pole and draw lines S1, S2, ..., S7, called rays.

In Fig. 10 we draw lines S1, S2, ..., S7 parallel to the similarly lettered lines in Fig. 11; these parallel lines form the string polygon. Through the intersection point of the two outside strings, S1 and S7, must pass the resultant R1.

This will give up only the vertical line through the center of gravity, and to find the location of the c. g. on the line, we repeat above operations with lines running horizontally through the c. g. of the items. The force polygon thus constructed (Fig. 12) has the weights marked off in the order the dotted lines follow each other.

Then the intersection of the two outside strings will give us the resultant E2. The intersection of R1 and R2 will be the location of the center of gravity of the whole airplane.

Considering the simplicity of finding the c. g. by the graphic method, it will aid us in relocating some of the items (motor) to bring the c. g. to a predetermined position relative to the trust or lift line (c. p.) to insure stability and good performance.

IN THIS article, and the introductory article of last month, we enter into a most important phase of stress analysis — that of "graphic Statics." Graphical methods are universally applicable to all problems dealing with forces and velocities and are therefore a means of solving equilibrium problems (balancing) as well as for determining stresses in framed structures.

The Vought V-143 Fighter Passes Tests

The Chance Vought Fighter, V-143 in flight. It is equipped with a 14-cylinder 750 h.p. Twin Wasp, Jr. Engine.

SUCCESSFUL flight tests at Rentschler Field recently marked the completion of Chance Vought Aircraft's latest type of airplane, an all-metal fighter developed from original designs by the Northrop Corporation. The new model represents a happy combination of Northrop's advanced position in the field of metal airplane design, and Chance Vought's long experience in the construction of high-performance military aircraft.

Designated as model V-143, the new airplane is a single-seater low-wing monoplane of exceptionally clean design. As tested at Wright Field by the Materiel Division, U. S. Air Corps, it was equipped with the fourteen-cylinder 750 h.p. Twin Wasp Junior engine. With this installation its performance equalled that of its larger competitors using much higher powers.

With an alternative power plant installation of the new nine-cylinder Wasp Junior engine developing 600 h.p. for take-off and 525 h.p. at critical altitude, the airplane is also extremely interesting. It combines brilliant performance with very low landing speed, thus facilitating the pilot's transition from training planes to combat types.

Model V-143 incorporates many advanced design features contributing to its outstanding performance. Included among these are a completely retractile landing gear which increases the airplane's top speed; wing flaps which give remarkably low landing speed, and cowl flaps for controlling the engine cooling within the proper limits.

A Hamilton Standard controliable propeller permits the utilization of maximum power both in climb and level flight, and may be optionally replaced by a constant-speed propeller providing still higher performance.

In the design of the cockpit, particular attention has been given to the pilot's comfort and convenience. The pilot is located as far forward as possible, so that his vision in the forward hemisphere is practically unrestricted. A sliding enclosure of transparent material protects him from wind and weather.

Normal armament of the V-143 as a fighter includes two .30 caliber machine guns mounted in the fuselage and synchronized to fire through the propeller disc, with 500 rounds of ammunition for each gun. If desired, .50 caliber guns, with 200 rounds of ammunition each, may be substituted for the .30 caliber guns. For bombing missions, the airplane may be equipped with two external bomb racks mounted under the wings and carrying a maximum of 300 pounds of bombs.

The structure of the airplane is metal throughout, with sheet metal covering except for control surfaces, which are fabric covered. The structural strength is sufficient to withstand the loads incident to acrobatic maneuvers and terminal velocity dives, and meets throughout the rigid strength requirements of the United States Government for a pursuit or fighter type airplane.

Despite its great structural ruggedness, it has a remarkable performance of the type most desirable in war. Low landing speed, an excellent rate of climb and an exceptional maneuverability for a ship having a super top speed. The use of alternative power plants is also a step in the right direction, for in war, a degree of interchangeability is often of great importance.

Principal characteristics of model V-143, when powered with the Wasp Junior engine, rated at 525 h.p. at 8,000 feet, are as follows:

Overall Span—33 ft. 6 in.

Gross Weight—4,060 pounds.

Maximum Speed at 8,000 feet—250 m.p.h.

Cruising Speed at 8,000 feet (75% power)—220 m.p.h.

Cruising Speed at 8,000 feet (50% power)—186 m.p.h.

Landing Speed with Landing Load—60 m.p.h.

Rate of Climb at 8,000 feet—2,100 ft./min.

Cruising Range at 8,000 feet (50% power)—1,070 miles.

When the ultimate in performance is required the airplane may be equipped as noted above, with the 14-cylinder Twin Wasp Junior engine, without any major change in the basic airplane structure.

Scientific Model Design Data

by GERALD RITZENTHALER

In this article, a serious attempt is made at designing model airplane wings according to scientific principles. More attention must be paid to this phase of model building if gas model design is to advance

WITH the present intense desire of many model plane builders to improve the design and construction of their models, it is only natural that much experimental work should be done along this line, and that model designing should be becoming more scientific. We have conducted thousands of tests in order to arrive at ideal designs and practical methods of construction for these designs.

Wing design is one of the most important considerations of model design, and since we do not have much information on low speed aerodynamics, we have to base our lines of progress more on observations and assumptions than on wind tunnel tests. We will discuss three phases of wing design in the order named. They are the plan form, the airfoil section and the structural design.

For a given area and span, an ellipse is the most efficient aerodynamical shape, so naturally we will incorporate this feature in our ideal design. The ellipse shape is also subdivided in that it will be a double ellipse, using the center of pressure of the root chord as the axis, and the distance to the leading or trailing edge as the radii of the ellipse. This gives a more efficient airflow and also helps to neutralize the twisting moments by keeping the centers of pressure in a straight line. Fig. 1 illustrates the shape of this wing.

The area of an ellipse is SPAN × ROOT CHORD × .7854. There are many ways of constructing an ellipse, the simplest being as follows: Find the span and root chord of a wing with the area you wish to use. Draw your C. P. line and your root chord line, locating the center of pressure of your airfoil (for ordinary usage one-third of the chord from the leading edge).

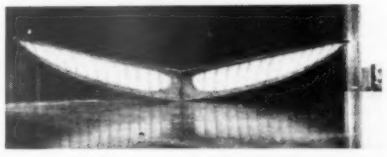


Fig. 4. Front view of the completed wing looking at the leading edge. The transmitted light clearly shows the ribbing.

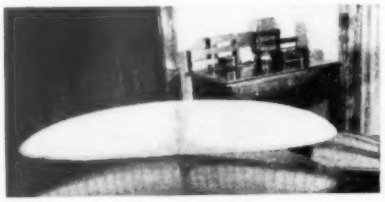


Fig. 3. The completed elliptical wing described by the author.

Using a string with tacks tied on the ends, the length of which is equal to the wing span, place your tacks on the C. P. line at the tips of the wing. Now as in Fig. 1, move your tacks equally in from the ends of the wing until the string can be distorted to point B which is the leading edge of your root chord. Following around the string with a pencil will draw the ellipse. Use the same method for drawing the trailing edge ellipse.

Now to come to the most important phase of the wing design, which is the airfoil section, and our latest conception of the ideal method of designing a section to meet your needs. We have very good reason to believe that the effect of changing the thickness ratio of an airfoil with a constant camber of the median line has a decidedly different effect on a model wing at low speeds than it has on a large plane wing at high speeds.

Our conclusion is that when you use a large plane airfoil section on a slow flying model, there is much more of a change in the profile drag than there is in the induced drag/lift ratio, and the thicker the section, the more pronounced the effect will be.

This statement is the result of our observations, and will have to be verified by wind tunnel tests. The reason for the foregoing statement is that at model speed the airfoil will not "cut" the air as it would at higher speeds, and it has the effect of greater viscosity of the boundary layer of air, which increases the drag coefficient tremendously. Now with a thick section, the effect of trying to displace a thick column of air will add much to the frictional qualities, acting as additional head resistance, and keeping the airfoil from having a smooth airflow.

This all leads us to believe that a good streamline for models would have the nose more pointed in order to avoid undue head resistance, and the slower the model's speed, the more pointed the section. From the basis of these assumptions, we want to keep the airfoil as thin as structural construction will permit, in order to decrease the profile drag by minimizing the amount of air that must be displaced in moving the airfoil through the air.

Working toward the lowest head resistance possible, choose the best mean camber for your type of model and using it as a median line, superimpose the upper and lower surfaces at equal distances from it. In doing this, keep the section as thin as your structural

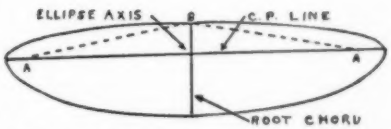


Fig. 1. The plan view of the wing form advocated by the author for model planes. It consists of two ellipses.

Fig. 2. The "Ritz" airfoil designed by the author for high performance models.

design will allow. For an airfoil with a high-lift coefficient, use a maximum camber of about .09 of the chord, working down towards a camber of .05 of the chord for an airfoil with about the best L/D possible.

The best position for the maximum ordinate on the low camber sections is at about one-third of the chord, graduating to 40% of the chord for the more highly cambered sections. One of the reasons for moving the maximum ordinate back with an increase in camber is to prevent having any vacuum on the under surface just back of the leading edge at low angles of attack. Fig. 2 shows one of the author's favorite sections designed by this method. It has a maximum camber of .075 of the chord, at a point 37.5% of the chord from the leading edge. The airfoil is ⅛ inch thick throughout, with the trailing edge tapered to a point, and the leading edge nicely rounded.

Now we come to the last and more practical part of the wing design which is the structural design. It can be seen at a glance that with an ellipse plan form, and so thin an airfoil section, that we would of necessity have to originate some new method of wing construction. Still working with the idea of the ideal wing in mind, we figured out a structural design which is entirely original and is one of the best we've ever seen for strength and lightness.

It also works in perfectly with the ellipse shape, and is very simple to build. Fig. 3 illustrates this method of construction. First draw up the plan form of your wing, and then draw a second ellipse shape inside it, leaving about ¾ of an inch at the leading edge, and about 1 inch at the trailing edge, tapering down to ½ inch at the tips. Also draw in a center section. Now cut these edges out of light ⅛ inch sheet balsa, glue the whole thing together, and let it dry on a flat surface.

(*Concluded on page 62*)

XUM

The Roberts Brothers Build a Nieuport

OUT of Los Angeles, Calif., comes a most interesting gas-powered job. This is a wartime type "28" Nieuport biplane built by the "Roberts Brothers," 8510 Hickory St., Los Angeles.

The boys have had many successful flights with it, thus demonstrating that a scale model and a biplane are practical for gas-powered jobs. They say that it has had its crack-ups, but that these mishaps have been entirely their own fault due to the use of low-pitched props, not enough offset for torque, making it loop and do wing-overs, etc. And, again, the little ship got mixed up with the telegraph wires occasionally, which was not so good for its health.

They say that it is very stable and handles itself very well in a strong wind, which should be the case with a biplane. A Kodak timer is used which limits the power to 30 seconds with one to two minute flights. A rudder control is also used which keeps the ship in a left turn in the glide.

This glide control is operated by a wire from rudder to switch, which in turn is operated by the Kodak timer. The rudder is thus turned to offset the torque when under power and when the motor cuts out, the rudder automatically turns to control the glide. This idea is credited to Wally McDowell, also of Los Angeles.

The Nieuport has a five-foot wing span and weighs four pounds, ready to fly. It is of all balsa construction and is silk covered. Thanks, fellows, this is good dope.

Plenty of Rearwins at Chicago

Miller gives you a close-up view of his Rearwin gas job.

THERE was a fine display of gas-powered jobs at the Chicago Meet, Pal-Waukee Airport, and in the crowd were a number of Rearwins. The latter models were conspicuous for their fine flying qualities and for an absence of crashes among them.

Demonstrating that model Rearwins are smaller than a P-26A.

And Now—a Gas-Powered Model Seaplane

by NATHAN FRANKE

This photo shows the poise of the pontoons just before takeoff. A very interesting project.

HERE are a few snapshots, taken from various angles, of a flying scale model Curtiss Hawk P6-E, built and flown by the writer.

The ship is equipped with floats and powered with a Brown Jr. motor of one-fifth horsepower. Its span is four feet and the weight of the ship, complete and ready for flight, is four and one-quarter pounds.

The batteries are located under the engine in the space taken up by the radiator in the large ship. A small knife switch is mounted directly in back of the batteries and is readily accessible through a sliding trapdoor in the bottom of the fuselage. All cowling is quickly removable for inspection purposes and any necessary motor repairs. Mounting the engine necessitated altering the lines of the nose but very little and I believe it still faithfully resembles its larger prototype.

There are many advantages in flying a float-equipped model in spite of the increased weight and drag of the pontoons. Unlimited landing space and unobstructed vision for long distances, especially over large bodies of water, in my opinion, far outweigh any disadvantages.

The pontoons are twenty-eight inches long, with the single step located slightly to the rear of the center of gravity of the ship. The bottoms are covered with one-sixteenth inch sheet balsa and are of concave "v" construction. The weight of both floats, including struts and ready to attach to the fuselage, is eight ounces. They are mounted with the nose down about three degrees to give the wings the necessary angle of attack for the quickest possible take-off.

On the first trial flights, a broken propeller curtailed any extended attempts, but in a later successful flight the ship lifted gracefully off the water after a run of approximately one hundred feet against a very light breeze.

Some difficulty was experienced in obtaining the proper rudder setting so that the ship would taxi in the straightest possible line to build up the necessary speed for the take-off. This can undoubtedly be overcome with a little experimenting and I am looking forward to some exceedingly interesting experiences on subsequent flights.

I certainly recommend a gas-powered model seaplane to all model builders as a most interesting form of sport and scientific study. It is most interesting to depart from cut-and-dried types and to break out into new fields.

A three-quarters view of the Franke gas-powered seaplane shows a most interesting job.

Building the Caudron-Renault Racer

by
PAUL W. LINDBERG
Model Editor and Designer for
POPULAR AVIATION

Compare this completed Caudron-Renault model with the photo of the full size plane on page 17. The model and large ship are identical.

THE Caudron Renault Racer, flown by Lt. Michel Detroyat, of France, won the Thompson trophy at the International Air Races of 1936. This ship is of French design and it is capable of very high speed. You will find it very easy to construct. Due to its clean and ultra streamline design, this model makes an unusually attractive display.

COLOR SCHEME

Entire ship—dark blue.
Striping, numerals, etc.—white.
Other small details—black.

CONSTRUCTION OF FUSELAGE

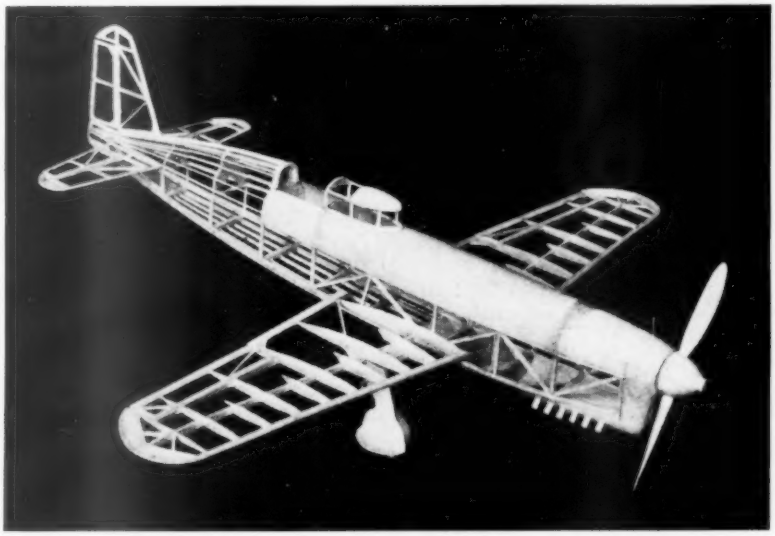
Place a sheet of ordinary wax paper over the plan to prevent cement from sticking to it. Construct one side of fuselage at a time. The longerons, vertical and diagonal braces, etc., are held in place until securely cemented, by inserting straight pins on either side of strips.

When two fuselage sides are completed, both are pinned to top view of plan; in such a manner, that the top longerons face down and the sides are at right angles with the table. The cross-members now are cemented in place, forming a rectangular fuselage.

Cut formers from 1/32-inch sheet balsa and cement in their respective positions as shown on plan. Select a soft piece of balsa for nose block, carve and sand to shape. Stiff paper is used for covering the fuselage around motor and top of fuselage to cockpit. The positions of all stringers are clearly shown on formers. 1/16x1/4-inch balsa re-enforcements are cemented to bottom longerons to receive hinge wire, which in turn is cemented to landing gear struts.

CONSTRUCTION OF WINGS

Cut all ribs from 1/16-inch balsa. Pin center spar in position on plan. Cement ribs in their proper locations. The leading and trailing edges are cut and sanded to shape and cemented to the ribs. The wing panels carry movable ailerons, which are a great help in controlling the flights. Make wing tips from 1/16-inch balsa.



The framework of the Caudron-Renault before covering. This will assist you in assembling your model.

ELEVATOR AND RUDDER

These are built up from 1/16-inch balsa strips. Select 1/16-inch flat sheet balsa for tips, etc. These are constructed upon the plan and removed when thoroughly dry so they can be sanded to a smooth finish.

LANDING GEAR

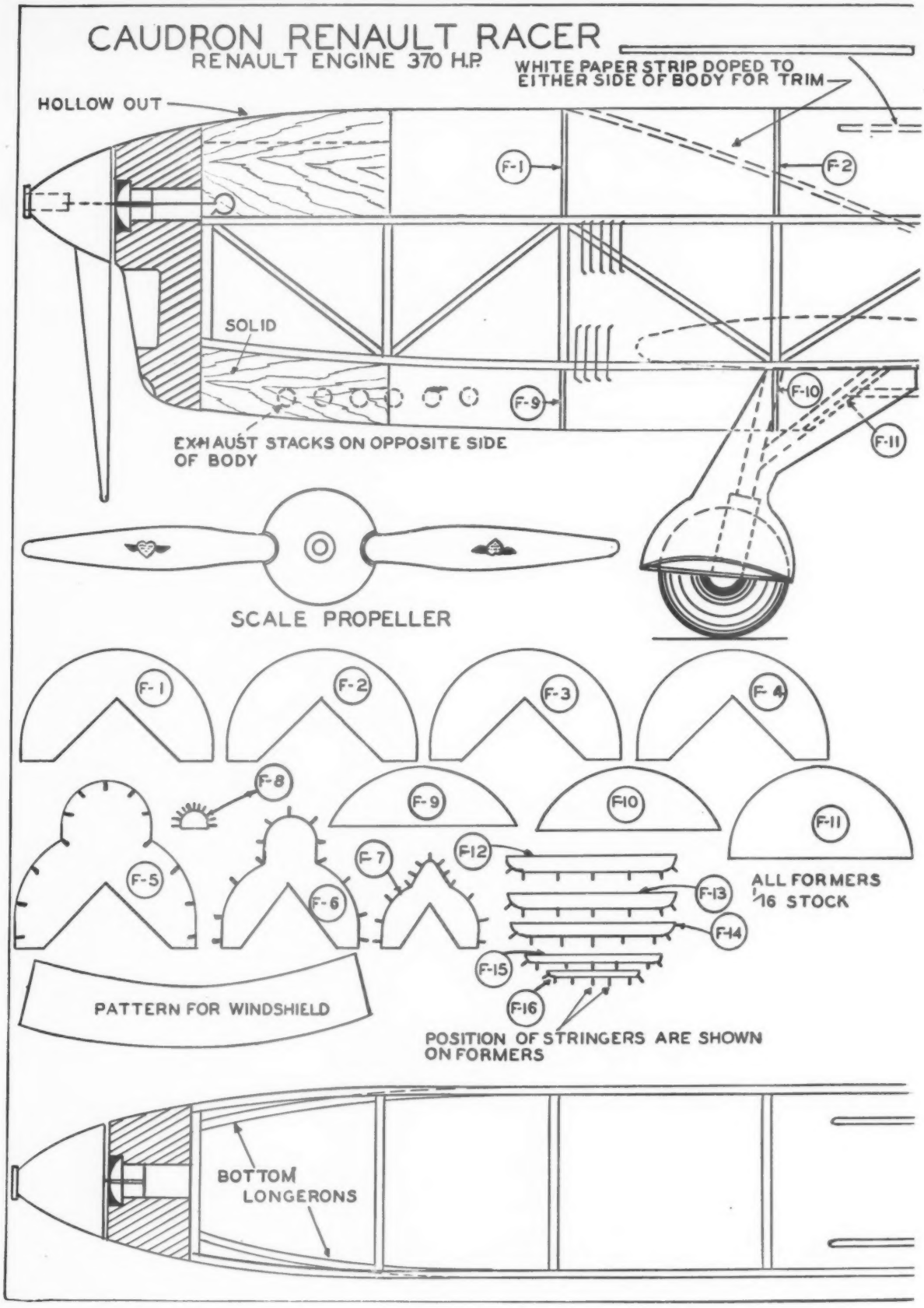
Select a strong grade of balsa for the landing gear struts and round to shape. Force a pin through aluminum U shape piece into strut. Top of strut is cemented into hole of block fitted to wing. Drill holes in aluminum, to receive axle, before bending to shape.

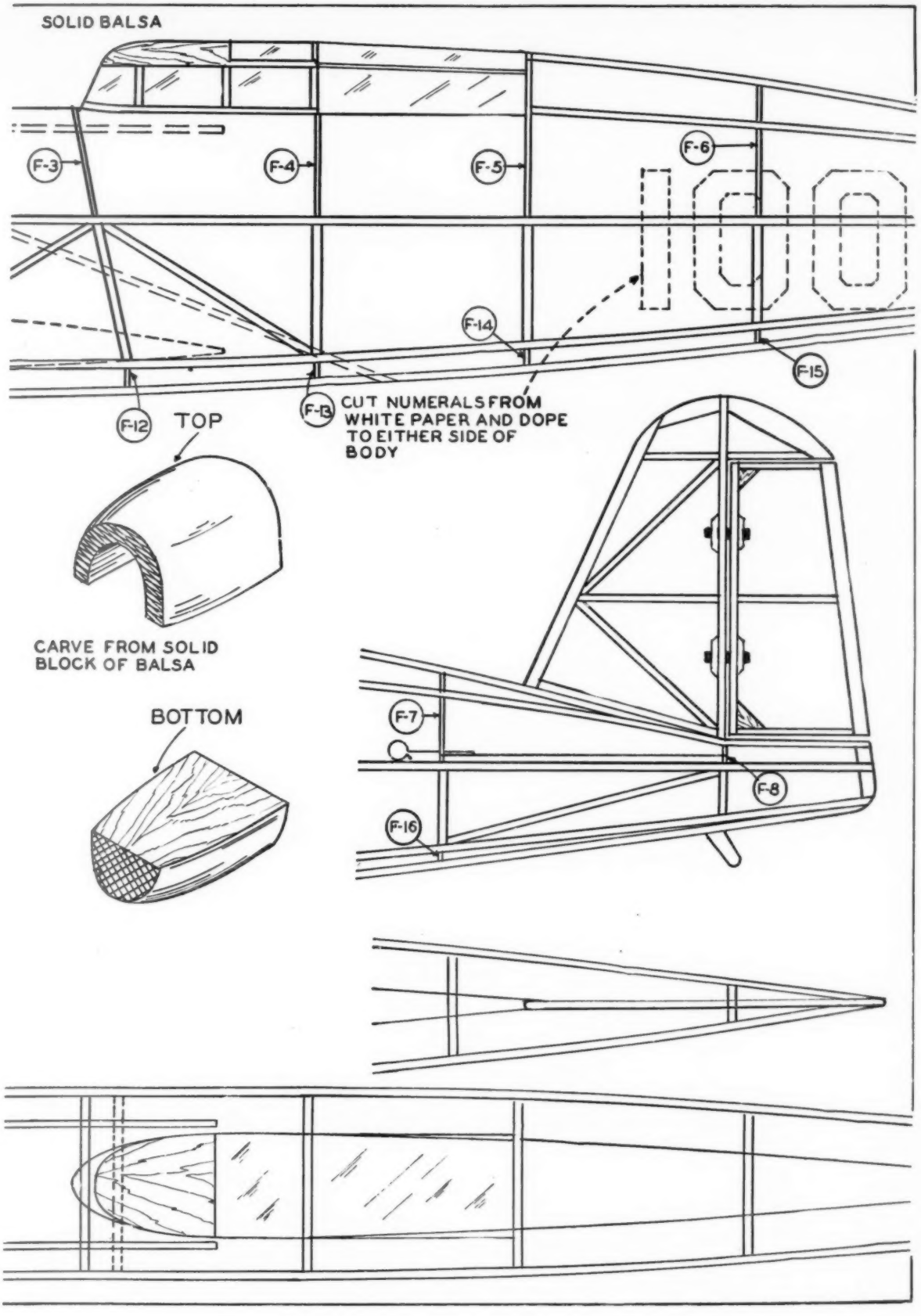
COVERING THE MODEL

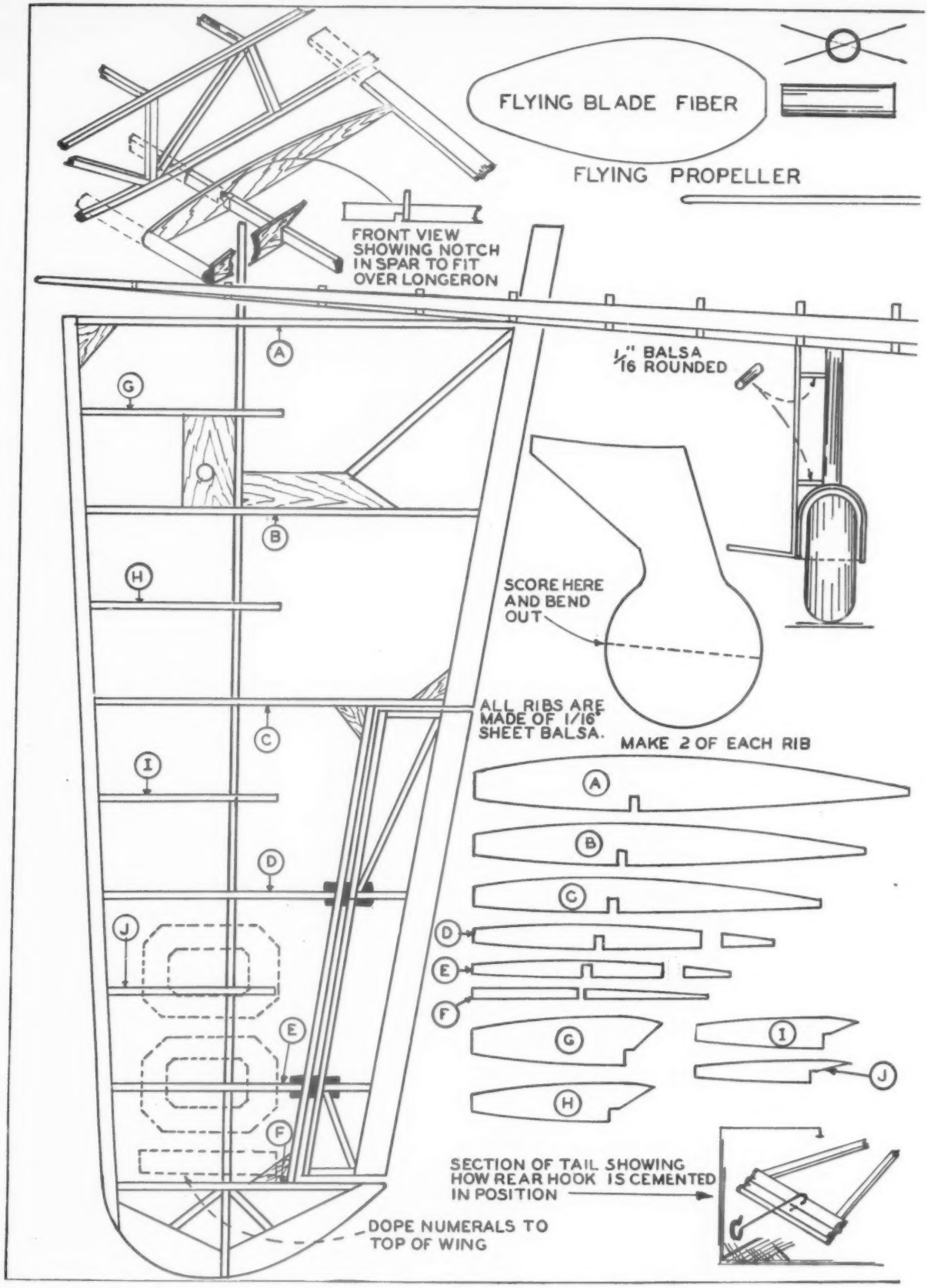
Apply tissue to the various framework members, using a light grade of model airplane dope to fasten it to outer edges. Stretch tissue as tightly as possible to remove all wrinkles. When edges have dried, apply coat of water to tissue. When all water has dried completely, tissue will become taut. May we suggest that you pin wings, elevator and such upon a flat surface to keep from warping.

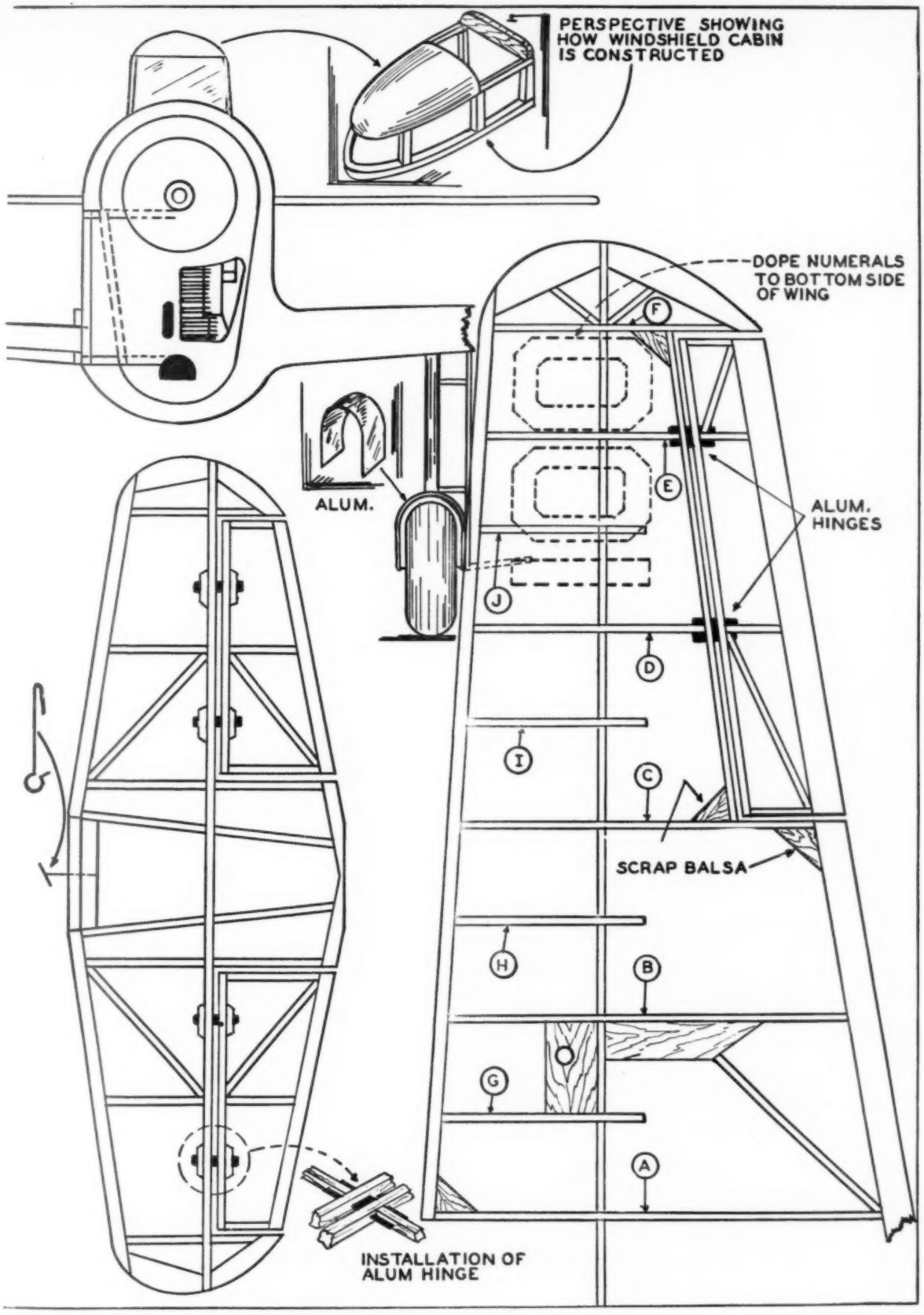
Next, apply coat of clear dope to all surfaces. Now apply colored dopes. Note: do not try to cover frame when it is completely assembled. Wings, elevator, etc., are cemented to fuselage after they have been completely covered with tissue. Care should be taken in doping to avoid bare spots or excessively heavy local deposits that weigh down the model.

(*Concluded on page 73*)


CAUDRON RENAULT RACER
RENAULT ENGINE 370 H.P.
WHITE PAPER STRIP DOPED TO EITHER SIDE OF BODY FOR TRIM
HOLLOW OUT
F-1
F-2
SOLID
F-9
F-10
F-11
EXHAUST STACKS ON OPPOSITE SIDE OF BODY
SCALE PROPELLER
F-1
F-2
F-3
F-4
F-8
F-9
F10
F-11
F-5
F-6
F-7
F12
F-13
F-14
F-15
F-16
ALL FORMERS 1/16 STOCK
PATTERN FOR WINDSHIELD
POSITION OF STRINGERS ARE SHOWN ON FORMERS
BOTTOM LONGERONS


SOLID BALSA
F-3
F-4
F-5
F-6
F-14
F-15
F-12
F-13
CUT NUMERALS FROM WHITE PAPER AND DOPE TO EITHER SIDE OF BODY
TOP
CARVE FROM SOLID BLOCK OF BALSA
BOTTOM
F-7
F-8
F-16


FLYING BLADE FIBER
FLYING PROPELLER
FRONT VIEW SHOWING NOTCH IN SPAR TO FIT OVER LONGERON
1/16" BALSA ROUNDED
SCORE HERE AND BEND OUT
ALL RIBS ARE MADE OF 1/16" SHEET BALSA.
MAKE 2 OF EACH RIB
A
B
C
D
E
F
G
H
I
J
SECTION OF TAIL SHOWING HOW REAR HOOK IS CEMENTED IN POSITION
DOPE NUMERALS TO TOP OF WING


PERSPECTIVE SHOWING
HOW WINDSHIELD CABIN
IS CONSTRUCTED
DOPE NUMERALS
TO BOTTOM SIDE
OF WING
ALUM.
ALUM.
HINGES
SCRAP BALSA
INSTALLATION OF
ALUM HINGE
F
E
J
D
I
C
H
B
G
A

Seversky P-35

(*Continued from page 22*)

ally-operated constant speed Hamilton Standards, and makes use of the most efficient pitch for take-off, climb, and cruising. A novel feature is that it may also be used as a sort of brake to prevent excessive speed in dives.

Major Alexander P. de Seversky was the designer of this new ship and used all his skill and experience as designer, manufacturer, and student of military tactics to produce it. One of the features he devised is the construction of a compartment in the wing that is liquid-tight; this is used as the fuel tank. Also, should the plane have the misfortune to descend on the water, these compartments will act as floats and will prevent the craft from sinking.

If the tank is punctured in a skirmish, it can be easily and repeatedly repaired from the outside without the bother of dis-assembling the entire wing. The wing itself is of the full-cantilever type and is constructed in one piece. A "multi-box" type of construction is employed and provides a very strong structure to withstand the terrific pressure exerted on it by the fast maneuvering possible. There is a recess in the bottom of the fuselage into which the wing fits, and bolts are used to securely fasten the two together.

Fuselage structure is of the all-metal, full-monocoque type and for added strength the tail surfaces are built as an integral part. To the rear of the pilot one of the fuselage bulkheads is built up to the top of the cockpit enclosure so that it forms a protection for the pilot in case of a nose-over.

By using the special Seversky "discelerator" flap, the P-35 lands at an unusually low landing speed in relation to its exceptionally high top speed. This top speed, by the way, has not been released and neither have any other performance figures.

The Seversky BT-8 does 176 MPH. with a 400 HP. engine. The P-35 is of the same type and has about 2½ times as much horsepower, only one pilot, a retractable landing gear, and smaller size and therefore should be somewhere near the 300 MPH. mark.

The Seversky Fighter on the cover, is No. 2 in the Berryloid Fleet. The insignia is the artist's conception of how the 77th might decorate its squadron. It is not yet established which squadrons will use this plane but it is likely that the 77th will be one of the first to receive this new fighter.

END

SPECIAL OFFER!!
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Detroyat

(*Continued from page 17*)

I did not count my chickens before they were hatched, but before I left France people were demanding and expecting me to establish new records with sensational times. It was my intention also to give an exhibition with my stunting plane for about ten minutes after the scheduled races.

Before the races I had hoped that I would honorably represent France in the United States. I have done that. *Now I contemplate, should the exploit be possible, trying for the coast to coast record.* I hope that my luck stays with me.

END

SLEEP OVERNIGHT
Coast-to-Coast

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AMERICAN
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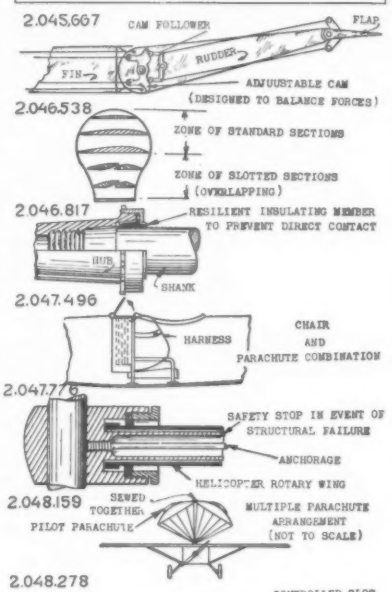
Recent Patents
by Raoul Hoffman



2,045,667. App. May 8, 1933. Trimming and Balancing Flap for Aircraft. Ass'd to Boeing Aircraft Corp., Seattle, Wash.

* * *

2,046,538. App. April 6, 1933. Screw Propeller. M. P. Vargas, Genoa, Italy.

* * *

2,046,817. App. July 25, 1933. Propeller. Ass'd to Am. Lurgi Corp., New York.

* * *

2,047,496. App. Feb. 2, 1932. Safety Apparatus. R. Seitz, Chicago, Ill.

* * *

2,047,776. App. April 23, 1934. Helicopter and Rotating Wing. R. Hafner, Vienna, Austria.

* * *

2,048,159. App. Jan. 10, 1933. Multiple Parachute Arrangement. F. L. Hoffman, Dayton, Ohio.

* * *

2,048,278. App. June 29, 1934. Air-Circulating Valve. F. Mazzini, Milan Italy.

* * *

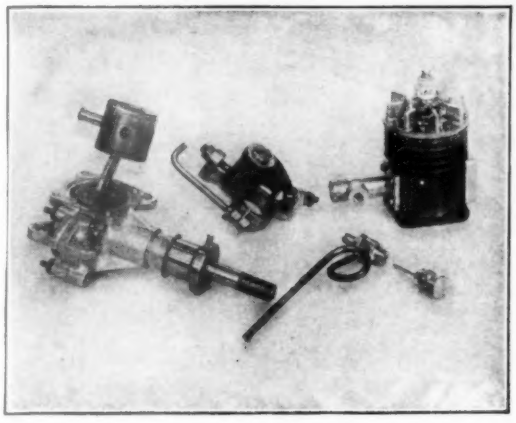
2,048,399. App. March 18, 1936. Aircraft. G. Loening, Mill Neck, N. Y.

* * *

2,050,903. App. Nov. 19, 1934. Airplane Drive. Oliver Topliff, Springfield, Ill.

G. H. Q. GAS MOTOR KITS

Last Chance . . . offered up to Nov. 15th only!



This is actually one of the most startling announcements ever made. Only five months ago, G. H. Q. blazed new trails in model airplane history with the news that a super-power engine may be had at $8.50 for a limited time only. Thousands of delighted men and boys availed themselves of this unusual opportunity since that time. We have decided therefore that we are now at liberty to withdraw this temporary offer and discontinue the delivery of all G. H. Q. gas motor kits after this month—selling finished motors only thereafter.

Here is your last chance to obtain the G. H. Q. Motor Kit, an engineering triumph—accomplished only after years of scientific aero-dynamic research. Thousands of letters have poured in from all parts of the country praising and recommending this mechanical achievement and the thrill of a lifetime will be yours with this motor kit—one of the most powerful ever constructed. Has broken records for amazing performance—flies model planes up to 10 ft. wingspread. Also used for boats and stationary use. Easy to start and simple as ABC to assemble—average assembly time is only 45 minutes. So easy only a screw driver is needed.

Everything is in the kit including plug, coil, condenser, tank, ignition wire, cylinder, piston, connecting rod, timer, crankshaft, all screws, nuts, bolts, etc. Every part is fully machined and finished. No oil, gas, batteries, or propeller included. Postpaid for only.....

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3. Motor cannot overheat.
4. Precision parts.
5. All parts replaceable.
6. Cylinder and piston lapped to within .0003.
7. Accurate die castings.
8. Crank shaft balanced and perfectly machined.
9. A light spark coil that is oil, water and gas proof.
10. Coil will not overheat or shortcircuit.
11. Main bearing is high-speed bronze, ground and lapped to size.
12. Condenser is gas, oil and water proof.
13. Cylinder and piston inspected cast iron to insure long life.
14. Chrome nickel steel shaft with 1⅛" bearing surface.
15. Connecting rod of high speed bronze.
16. Carburetor assembly accurately designed and made.
17. Needle valve and valve body machined together.
18. Breaker assembly compact, fool-proof, long wearing, replaceable and adjustable.
19. Easily inverted and runs in either direction.
20. Motor starts and runs on 2-ounce battery.
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23. Strongest miniature motor.
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The famous motor complete, entirely assembled on stand. Tested and run before shipment—Performance guaranteed —1/5 horsepower at 3000 to 7000 R.P.M.—No oil, gas or batteries included. Postpaid for only.....

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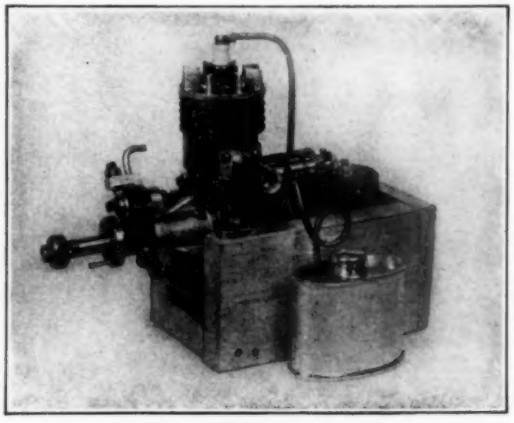
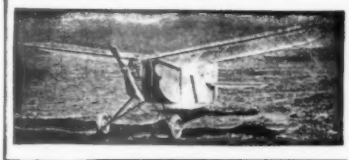


FREE 1 finished fly wheel mounted on motor with every finished motor. This offer not for dealers.

HERE IS NEWEST G. H. Q. SENSATION!



G. H. Q. Sportster kit specially designed for G. H. Q. Gasoline motor but may be used for any other motor of like weight and power. Built according to scientific aero-dynamic principles—Has made hundreds of successful flights without crackup—Marvelous glider . . . . And what a climber, 4 hour flights are common! A complete kit of all parts including plan, all wood, wire, wheels, metal and other parts. Postpaid for only

$5.00

Send 3c for illustrated catalog of gasoline motors, gasoline planes, gasoline accessories and parts

We have a complete line of kits from 10c to $1.00

A GUARANTEE

G. H. Q. machinists have successfully constructed hundreds of finished motors from the kits without having had any motors which did not operate satisfactorily. Should any purchaser be unable to assemble a working motor he may return parts to us with $4.50 (charge for assembling and postage) plus cost of any damaged and missing part. Finished motor will be shipped in a few days.

GAS MOTOR ACCESSORIES

Spark Coil (Non-overheating)	$1.50
Spark Plug (24-⅜")	.75
Condenser	.10
Wheels Hubs (⅛" I.D.) per pair	.50
Propeller	1.50
Flywheel	1.50
Battery (special 2 oz. 4½ V.)	.50
Gas Tank (1 oz. streamlined)	.50
Midget Switches	.35
Propeller Blanks, 14" diameter, 8" pitch	.25
Engine Instruction and Assembly Booklet	.10
Bamboo Paper, 2 sheets for	.15
Silk (special for gas jobs), sq. yd.	.45

G. H. Q. MODEL AIRPLANE CO., 854 East 149th St. New York, N. Y.

Jump

(*Continued from page 22*)

Such incidents occur but rarely as the average jumper always "gives his 'chute a chance." The proof of the pudding is in the fact that this was the only mishap of its kind in over three hundred training leaps which were made at the school that year.

The care of the 'chute is something which requires constant attention, calling for a complete periodic check and an accurate record of every chute in active service. The "report card" insures this.

Once every sixty days the 'chute must be opened, thoroughly checked and then repacked after being hung on a drying-rack for several days. In every instance where a 'chute has been exposed to excessive moisture at any time the same procedure must be repeated. The life of the silk is greatly diminished if left packed in a damp condition and its dependability is seriously decreased.

Once each year a 'chute is "drop-tested." That is, it is attached to a dummy and dropped from a plane. As the 'chute leaves the plane the rip cord is mechanically pulled by a rope fastened to the plane. These tests are usually conducted from an altitude of about two hundred feet and one rarely sees a chute not fully opened before it strikes the ground. However, that does not mean it would be a sane policy to make it a practice of jumping at that altitude.

The life of the army 'chute is but six years. There is no recall. So completely does Uncle Sam believe in this air "life saver" that he takes no long chances. Every chute is taken out of service at the end of this period regardless of its seemingly good condition from all outside appearances.

At the time, the army was first considering the 'chute as Air Corps equipment, a series of most exacting tests were conducted to determine its practicability. The final test came when 'chutes were dropped from planes diving 200 miles an hour—with a 400 pound dummy attached to them! The test was passed successfully.

To the average person not fully acquainted with the parachute, the idea of jumping is synonymous with the more positive means of insuring quick and certain death. The old theory that a state of unconsciousness would conquer the jumper, if he did not pull the rip cord immediately, has long since been dispelled.

Regular exhibition jumpers make delayed falls their business and thousands have been thrilled by the sight of a bullet-like object hurtling earthward followed by that slim trail of flour streaking out behind the plunging daredevil. For three . . . four . . . and perhaps five thousand feet he continues his mad descent. Suddenly the pilot chute leaps out, quickly followed by the main. Perhaps even that resounding whack can be heard as the chute opens fully to receive the rushing air. What a relief for the crowd. Just bread and butter for the fellow in the harness.

Another popular belief that the velocity of the jumper increased in proportion to the length of his free fall has been proven erroneous. Tests conducted by the army disclosed some interesting facts on this subject. It was found that the average free-falling body reached its maximum speed of some 125 miles an hour, the rate of fall increasing to that velocity and then remaining approximately constant.

This terminal speed might even decrease as he came near to the earth due to a greater air density. Thus, strange as it may seem, the pilot who finds it necessary to "bail out" of a plane diving, say, at the rate of 300 miles an hour, would feel the opening shock much less if he delayed the actual time of pulling the rip-cord. Of course, that policy would depend on one vital factor, just how near he was to terra firma at the time he leaped.

Another frequent question of those not fully conversant with the art of parachute jumping is, "How soon will it open?" Perhaps the sickening thought of falling through space is largely responsible for this query. At any rate, under normal conditions the average chute should be fully opened approximately 300 feet after the rip cord has been pulled.

A conservative officer of the Air Corps, with years of flying time to his credit and who has already made two emergency leaps, once stated that he would never advise anyone to attempt a parachute leap under 500 feet of altitude. However, there are exceptions to all rules. The level-headed leap of a member of the Marine Corps acrobatic team at the annual air races at Miami, several years ago could easily be classed as this exception.

As his plane fell into a spin from an inverted position at 1,000 feet he struggled to make a recovery. It appeared as though he was directly over the crowded grandstands. The twisting plane failed to respond to his efforts. There was but one thing to do—jump and jump quickly. He left the plane at 600 feet as every pair of eyes in that crowd looked on in horror.

Interminable seconds passed as he fell side by side with that slowly gyrating plane. He realized that if he attempted to pull the rip cord now an almost inevitable fouling of the chute in the tail would result. The fear-frozen crowd stared in breathless silence as their hopes for his life rapidly faded. Suddenly they saw him literally push himself away from the fuselage. At 350 feet he pulled the rip cord. Two hundred feet later the chute billowed out. He landed in what seemed a split second later, uninjured.

The next day the stands were jammed; people are forever attracted where possible death stalks.

THE LAST WORD IN GAS MODELS

★

Span OVER 6 FT.
Length OVER 3½ FT.

The **REARWIN** *Speedster*

Sensational Performance

Flies 20 M.P.H. Over 30 minutes on ½ oz. gaz (capacity 1 oz.). Takes off in 25 feet. Lands at 16 M.P.H. Full Size Plans.

Full size plans, ready cut out ribs, Latest Type M. & M. air wheels, aluminum motor mount, sheet aluminum for cowling, special metal fittings, veneer, all balsa parts cut to correct size, tubing, rods, springs for shock absorbing landing gear and clear and colored dopes. This fine kit is complete down to special bolts, screws and many other parts too numerous to mention here. HIGH QUALITY and REAL VALUE. COMPLETE KIT only **$7.00.**

COMPLETE KIT INCLUDING BABY CYCLONE MOTOR **$22.75**

Add 50c extra to cover cost of packing and mailing.
(West of Mississippi add 10%; Canada, 10%; Foreign, 15%.)

Note:
The Baby Cyclone or any light model engine can be installed in this Rearwin Model.

Send Orders to

AVIATION PRODUCTS CO.
619 S. Federal St. CHICAGO, ILL.

Model Supply Sale!!!

When a house with the reputation **UNIVERSAL** enjoys puts on a sale it's time to sit up and take notice. As one of the leading model supply houses of America, we ask you to look over the bargains offered here . . . they prove that **UNIVERSAL** sets the pace for high quality model supplies at lowest prices. We are leading the way to save you money . . . order at once and save . . . all merchandise guaranteed to be first quality and you must be 100% satisfied or your money back.

SEE OUR BIG FREE OFFER . . . DETAILS BELOW:

Dealers! Model Builders Save Money . . . Order Direct From This Ad . . . NOW!

Balsa Strips

18" lengths	For Orders Under $2.50	For Orders Over $2.50
1/32x1/16	100 for 5c	200 for 10c
1/16 sq.	100 for 5c	200 for 10c
1/16x3/32	40 for 5c	100 for 9c
1/16x3/8	40 for 3c	100 for 9c
1/16x3/16	20 for 5c	100 for 12c
1/16x1/4	18 for 5c	100 for 13c
1/16x1/2	7 for 5c	50 for 15c
3/32 sq.	35 for 5c	100 for 12c
1/8 sq.	30 for 5c	100 for 14c
1/8x3/16	14 for 5c	50 for 12c
1/8x1/4	10 for 5c	50 for 13c
1/8x3/8	6 for 5c	25 for 10c
1/8x1/2	4 for 5c	25 for 13c
3/16 sq.	10 for 5c	50 for 16c
3/16x3/8	5 for 5c	20 for 16c
1/4 sq.	8 for 5c	50 for 20c
1/4x1/2	4 for 5c	25 for 19c
3/8 sq.	3 for 5c	25 for 27c
1/2 sq.	3 for 5c	25 for 27c

See ordering instructions for 36" length prices.

Balsa Prop Blocks

	For Orders Under $2.50	For Orders Over $2.50
1/2x 3/4x 5	7 for 5c	12 for 5c
1/2x 3/4x 6	7 for 5c	12 for 5c
3/4x1 x 7	3 for 5c	12 for 14c
3/4x1 x 8	3 for 5c	12 for 17c
3/4x1 1/4x10	2 for 5c	6 for 15c
3/4x1 1/4x12	2 for 6c	6 for 17c
1 x1 1/2x12	1 for 6c	6 for 19c
1 x1 1/2x15	1 for 7c	6 for 26c

Carved Balsa Props

	For Orders Under $2.50	For Orders Over $2.50
5"	1 for 4c	12 for 22c
6"	1 for 5c	12 for 25c
7"	1 for 6c	12 for 33c
8"	1 for 7c	12 for 38c
9" & 10"	1 for 10c	12 for 48c
12"	1 for 12c	12 for 58c

Colorless Cement

	For Orders Under $2.50	For Orders Over $2.50
1 oz. bots.	1 for 5c	6 for 22c
2 oz. bots.	1 for 8c	6 for 40c
4 oz. bots.	1 for 15c	6 for 35c
1 pt.	1 for 50c	1 for 35c
1 qt.		1 for 65c
1 gal.		1 for 1.60

Birch Wheels—Light, strong

	For Orders Under $2.50	For Orders Over $2.50
1/2"	pr. for 2c	12 for 5c
3/4"	pr. for 3c	12 for 6c
1"	pr. for 4c	12 for 8c
1 1/4"	pr. for 5c	12 for 10c
1 7/8"	pr. for 8c	12 for 15c

FREE! With Orders of 50c or more 2 Sheets Jap Tissue (any color except silver) and your choice of any 3 Plans (See listing*) Value 30c.

Free with $2.50 order and over—12 plans and 12 sheets of tissue, value 75c.
Free with $5.00 order and over—1 gallon of colorless cement (add 75c for can and packing). 1 gallon equals 128 ounces which retails at 5c each.

All Merchandise Sold With A Positive Money Back Guarantee. Order Today!

Balsa Balloon Wheels

	For Orders Under $2.50	For Orders Over $2.50
1/2"	pr. for 2c	12 for 9c
3/4"	pr. for 3c	12 for 11c
1"	pr. for 4c	12 for 14c
1 1/2"	pr. for 8c	12 for 19c
1 7/8"	pr. for 8c	12 for 35c
3"	pr. for 15c	6 for 37c

Celluloid Wheels

	For Orders Under $2.50	For Orders Over $2.50
3/4"	pr. for 5c	12 for 24c
1"	pr. for 7c	12 for 25c
1 1/4"	pr. for 9c	12 for 35c
1 7/8"	pr. for 15c	12 for 60c
3"	pr. for 30c	6 for 75c

Aluminum Cowlings
Closed, open, or drag ring

	For Orders Under $2.50	For Orders Over $2.50
1 1/2"	1 for 15c	3 for 25c
2"	1 for 18c	3 for 35c
2 1/2"	1 for 20c	3 for 43c
3"	1 for 25c	3 for 55c
4"	1 for 35c	2 for 52c

Sheet Aluminum

	For Orders Under $2.50	For Orders Over $2.50
.0003x3 1/2"	.2 ft. for 1c	25 ft. for 10c
.002 thick	sq. ft. for 8c	5 ft. for 35c
.005 thick	sq. ft. for 10c	5 ft. for 50c
.010 thick	sq. ft. for 17c	5 ft. for 75c

Aluminum Tubing
(Special 1/100" wall)

	For Orders Under $2.50	For Orders Over $2.50
1/16 O.D.	1 ft. for 9c	5 ft. for 30c
3/32 O.D.	1 ft. for 7c	5 ft. for 32c
1/8 O.D.	1 ft. for 7c	5 ft. for 32c
5/16 O.D.	1 ft. for 9c	5 ft. for 40c
1/4 O.D.	1 ft. for 10c	5 ft. for 45c

Balsa Sheets

18" lengths	For Orders Under $2.50	For Orders Over $2.50
1/64x2	3 for 5c	20 for 16c
1/32x2	4 for 5c	20 for 14c
1/16x2	4 for 5c	20 for 17c
3/32x2	3 for 5c	15 for 15c
1/8x2	3 for 5c	15 for 16c
3/16x2	2 for 5c	10 for 15c
1/4x2	2 for 5c	8 for 16c
1/2x2	1 for 5c	5 for 20c

For sheets 3" wide, double the 2" price. See ordering instructions for 36" length prices.

Balsa Planks

18" lengths	For Orders Under $2.50	For Orders Over $2.50
1"x1"	1 for 4c	2 for 6c
1"x1 1/2"	1 for 8c	2 for 8c
1"x2"	1 for 9c	2 for 13c
1"x3"	1 for 14c	2 for 20c
1 1/2"x1 1/2"	1 for 12c	2 for 20c
2"x2"	1 for 16c	2 for 23c
2"x3"	1 for 20c	2 for 32c
2"x6"	1 for 35c	1 for 30c

See ordering instructions for 36" length prices.

Clear Dope or Banana Oil

	For Orders Under $2.50	For Orders Over $2.50
1 oz. bots.	1 for 5c	6 for 22c
2 oz. bots.	1 for 7c	6 for 40c
4 oz. bots.	1 for 13c	3 for 35c
1 pt.	1 for 45c	1 for 33c
1 qt.		1 for 65c
1 gal.		1 for 1.45

Thinner same price as clear dope.

Colored Dope

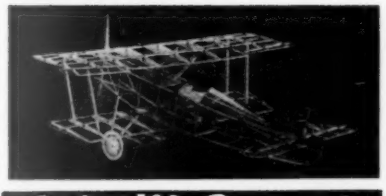
White, Yellow, Orange, Red, Green, Olive Drab, Blue, Black, Silver, Gold or Gray.

	For Orders Under $2.50	For Orders Over $2.50
1 oz. bots.	1 for 8c	6 for 25c
2 oz. bots.	1 for 10c	6 for 45c
4 oz. bots.	1 for 19c	3 for 50c
1 pt.	1 for 65c	1 for 40c
1 qt.		1 for 75c
1 gal.		1 for 1.90

S-P-E-C-T-A-C-U-L-A-R 15" FLYING SCALE MODELS

MOVABLE COCKPIT CONTROLS

Each kit in a beautiful box. Contents: carved balsa true pitch prop; Jap tissue; cement; dope; printed sheet balsa; strips cut to size; music wire; rubber; finished wheels and nose plugs; insignia; sand paper; cellophane; plans and instructions 17"x22", super detailed.



4 for $1.00 Postpaid

Post & Roger's Plane, Great Lakes Trainer, Northrop Fighter, New Monocoupe, Douglas Gull Wing, Fokker D VII, Ben Howard's Ike, Waco Taperwing. All 15" wingspreads.

We Wont Be Undersold! BUY NOW!

***Plans:**

	For Orders Under $2.50	For Orders Over $2.50
Full size, 17"x22", detailed with movable cockpit controls. Post & Roger's Plane, Great Lakes Trainer, Northrop Fighter, New Monocoupe, Douglas Gull Wing, Fokker D VII, Ben Howard's Ike, Waco Taperwing. All 15" wingspreads.	1 for 10c	8 for 40c
	3 for 25c	24 for 1.08
	3 for 50c	64 for 2.50

Plans may be ordered separately at prices listed . . . postage FREE.

Jap Tissue

	For Orders Under $2.50	For Orders Over $2.50
20x24 White	2 for 5c	12 for 11c
	6 for 8c	25 for 22c
Colored asst.	2 for 5c	12 for 14c
	6 for 8c	25 for 29c
Silver	1 for 5c	12 for 21c
Super Fine	1 for 5c	12 for 40c

Rubber

	For Orders Under $2.50	For Orders Over $2.50
skein—225 ft.	20 ft. for 5c	skein .35
.045 sq. 3/32 flat	20 ft. for 5c	skein .40
1/8 flat	12 ft. for 5c	skein .70
3/16 flat		lb. 1.00
Any size		

Dummy Radial Engines-cell

	For Orders Under $2.50	For Orders Over $2.50
1 1/2"	1 for 15c	3 for 40c
2"	1 for 20c	3 for 55c
3"	1 for 25c	3 for 70c

Brass Bushings or Eyelets

	For Orders Under $2.50	For Orders Over $2.50
1/16	dz. for 3c	100 for 12c
3/32	dz. for 4c	100 for 15c
1/8	dz. for 5c	100 for 18c

Thrust Bearings (Hard Steel)

	For Orders Under $2.50	For Orders Over $2.50
Small	5 for 5c	dz. for 6c
Small		gr. for 55c
Large	6 for 8c	dz. for 7c
Large		gr. for 70c

Wire (Straight Lengths)

	For Orders Under $2.50	For Orders Over $2.50
No. 6	10 ft. for 5c	100 ft.—15c
No. 8	10 ft. for 5c	100 ft.—18c
No. 10	10 ft. for 5c	100 ft.—20c
No. 12	10 ft. for 5c	100 ft.—23c
No. 14	10 ft. for 5c	100 ft.—26c

Insignia Sheet

	For Orders Under $2.50	For Orders Over $2.50
24 & markings for tail and rudder, Gummed.	1 for 5c	dz. for 36c
	6 for 25c	100—1.75

Washers

	For Orders Under $2.50	For Orders Over $2.50
1/8 or 1/40 O.D.	12 for 1c	100 for 5c
	144 for 10c	200 for 9c
Sandpaper	1 pkg. 5c	12 pkgs. 25c
Noseplugs	12 for 5c	100 for 40c
Reed	3/32 or 1/16 6 ft. 2c	50 ft. 18c
Reed	3/32 or 1/8 5 ft. 2c	50 ft. 20c
Bamboo	1/16sq.x12—40 for 5c	144 for 15c
	1/16x1/8x15—1 for 1c	12 for 6c
Model Pins	1 pkg. 5c	12 pkgs. 35c

Sheet Celluloid

(6"x8")	1 for 5c	12 for 45c

Wood Veneer

Paper 20x30	1 for 9c	1 for 7c
Paul-O-Wina 5"		10c
Jap Props (hand carved, very light), (add 5c per inch up to 10 inches.)		

3 for 25c, postage FREE

Here's a new fleet ready to take off . . . solid replicas with all complete supplies and accessories and short cut plans. Your choice of: Northrop Fighter, Curtiss Attack, Seversky Racer, Brown Racer, Mr. Mulligan Racer, Wedell Williams Racer, Mystery Ship, Boeing Fighter —3 for 25c. Postage Free.

HOW TO ORDER SUPPLIES

Free postage on all orders from 75c to $2.50. Orders under 75c add 15c postage. West of Miss., add 10c extra. Canada add 15% extra. Orders over $2.50 (Because of large discounts) sent Railway Express collect. NO COD'S! When ordering 36" lengths, add 10c extra for packing and double 18" prices.

UNIVERSAL MODEL AIRPLANES, Inc., 139E Emerson Pl., Brooklyn, N. Y.

Hallman Motor

(*Continued from page 36*)

connecting rod bearings, Babbitt lined main bearings, radial truss bearings, hollow drill crank shaft, and a pressure oil system specially adapted to this motor to provide proper lubrication.

The Hallman motor meets requirements of reduced weight in the ways already indicated.

These improvements, coupled with the fact that the Hallman motor is economical in operation and surprisingly low in price, make this motor ideal for the young flyer building his own plane.

The new Curtiss Y1A-18 is the first twin-engine attack plane of the U. S. Army Corps. Powered by two 1000 H.P. Wright Cyclones, these planes are formidable weapons for national defense.

★

CURTISS AEROPLANE & MOTOR COMPANY

BUFFALO NEW YORK

A Division of Curtiss-Wright Corporation
"The Pioneers of Aviation"

Curtiss-Wright

(*Continued from page 28*)

exceptional degree of stability and control. This wing has been found to possess unusually high lift characteristics as well as low drag, and has been proved to be outstandingly favorable in all phases of flight.

The type of construction used in the wing is multi-cellular stressed skin, 24ST Alclad being used throughout. The wing is built up of five shear beams with ribs spaced along the span at 20 inch intervals. The ribs and beams are designed to carry only the shear loads, the skin with its reinforcing stringers carrying the compression and tension loads.

The flaps provided are of the split trailing edge type extending over 55% of the span. They are particularly effective and reduce the gliding and landing speeds more than 10 MPH when they are extended. The ailerons are of all-metal stressed skin construction and are dynamically and statically balanced.

The wing-to-fuselage attachment is accomplished through a riveted channel on the fillet and a riveted attachment of each bulkhead to the wing skin proper. Just outboard of the landing gear a splice is located, making it possible to detach the wing for shipment, inspection, etc.

The horizontal and vertical tail surfaces of the airplane are of similar construction to the wing and are cantilever throughout. The fin and stabilizer are built integral with the fuselage itself, all loads being carried through the skin and stiffener assembly.

The tail-wheel unit consists of an 8 inch streamline wheel and tire mounted on a single-sided fork of the latest military type. Its oleo strut has a 3 inch travel and is equipped with a taxiing spring. The unit is steerable for taxi control and is equipped with an automatic release device which permits it to caster through 360 degrees for easy handling in the hangar.

The landing-gear is of the fixed cantilever type for simplicity and easy maintenance. For drag reduction the wheels are held up in the fairing throughout the flight and are dropped automatically to the extended position for landing coincident with the lowering of the flaps. The length of the oleo stroke provided is approximately 8 inches, which insures uniformly smooth and easy landings, and the strut incorporates a rubber block taxiing unit. Hydraulic brakes are standard equipment, with a parking control provided in the front cockpit.

The plane is designed to take interchangeably any of the Wright Whirlwind series of 7 and 9 cylinder engines of power ratings between 250HP and 420HP. These engines may be interchangeably installed without change in the engine mount and only slight modifications to the cowling.

The fuel system consists of two individual tanks installed in the wing. The tanks are of approximately 35 gallons capacity each.

	Wright Whirlwind R-975-E2		Wright Whirlwind R-760-E2	
PERFORMANCE DATA:	As Trainer	Incl. Armament	As Trainer	Incl. Armament
High Speed (MPH)	215	203	193	182
Cruising Speed (MPH)	201	190	180	169
Stalling Speed (MPH)	54	58	53	57
Rate of Climb (ft/min)	2050	1750	1570	1370
Range, Full Throttle (miles)	430	406	483	456
Cruising Range (miles)	602	570	756	710
Service Ceiling (feet)	25000	20000	23000	19000
Absolute Ceiling (feet)	26000	22500	25000	21500
Wing Loading (lb/sq. ft.)	15.4	18.4	14.5	18.4
Power Loading (lb/b.HP)	6.4	7.6	7.9	10.
WEIGHTS:				
Gross Weight (lbs)	2692	3200	2531	3200
Weight Empty	1827		1666	
Useful Load:				
Crew, 2 @ 200			400	400
Fuel, 70 gals.			420	420
Oil, 6 gals.			45	45
Total normal useful load			865	865
Normal Gross			2692	2531
Design Gross			3200	3200
Extra Useful Load for Armament			508	669

DIMENSIONS:

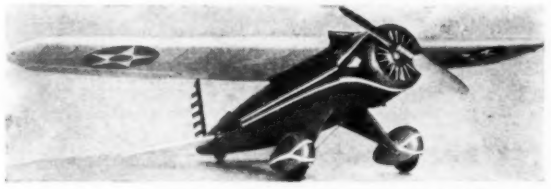
Length Overall	25 ft.
Wing Span	35 ft.
Height	7 ft. 6 in.

NEW CURTISS F11C4 NAVY PURSUIT

28" Span. Length 20½". Weight 4 oz. 1" Scale

THE MOST EXCLUSIVE AND FINEST EQUIPPED MODEL IN THE WORLD
A special De Luxe model, one of the most beautiful and finely detailed ever made, with its special exact scale 3¾" celluloid, 1000 H.P. type, Wright Cyclone motor, having aluminum push rods, cylinder fins, etc., like real motor. Also in set are 4" aluminum cowl ring, 9" carved spruce semi-scale flying propeller, colored star and rudder insignia, 2" celluloid balloon wheels, silver dope, paint, black, red striping, Navy lettering, wire parts formed, axles, rubber motor, windshield, instrument board, flying wires, 4 aluminum step plates, aluminum wing walks, ready cut wheel pants, etc. All other parts printed on balsa. Detail scale drawing.
Construction Set complete, postpaid..... $4.50

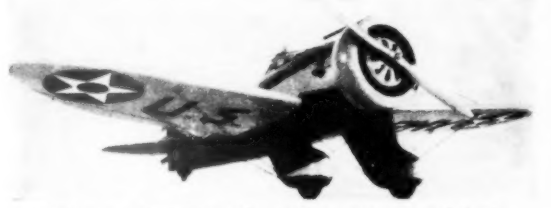
41" LOCKHEED ARMY SPEED VEGA



41" Span. Length 28". Weight 8 oz. 1" Scale

This new model, built very strong yet light in weight, is practically crashproof and will out-perform any large scale model built. Rises from ground in 10 feet and flies over 650 feet. Set contains all parts printed on balsa, ready cut pant cores, 4¼" turned motor front, 11" steel type carved paulownia wood propeller, 2½" balsa wheels, tail wheel, formed wire parts, 28' rubber, 3 oz. yellow dope, 2 oz. blue, ½ oz. black, 2 oz. glue, cement covering, full size scale drawing, and all parts.
Construct on Set complete, postpaid..... $4.95

NEW BOEING P26A ARMY FIGHTER



22" Span. Length 17½". Weight 2½ oz. ¾" Scale

Above photo shows finest equipped model of this plane on the market. Having ready made motor, cowl, prop, etc., it is very easy to build and is a beauty. Const. set contains 3" celluloid motor, 3¼" spun tapered aluminum cowl ring, 8" steel type paulownia wood prop, 1⅝" celluloid wheels, tail wheel, insignia, windshield, instrument board, 1 oz. yellow dope, 1 oz. blue, cement, glue, all parts printed on balsa, and drawing.
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NEW LOCKHEED P24B ARMY FIGHTER

32" Span. Length 20½". Weight 3½ oz. ¾" Scale

New scale special detailed model, equipped with 2" pneumatic rubber tired M. & M. air wheels. Set also includes ready made and painted pilot's bust shown, 2 aluminum step plates, 9" carved steel type prop shown, all parts printed on balsa, turned balsa motor front, 3 oz. colored dopes, paper cement, 2 oz. glue, covering, colored insignia, formed wire parts, nose plug with brass bearing, rubber, 9 metal motor exhaust pipes shown on cowl, full size scale drawing, and all parts to build.
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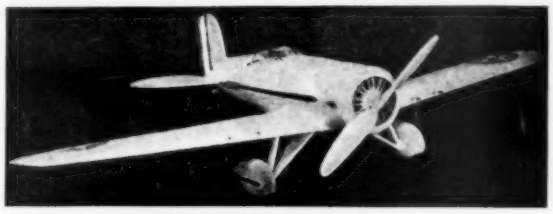
N E W

NEW LOCKHEED P23A NAVY FIGHTER



COMBINATION LAND AND SEA PLANE SET
32" Span. Length 20½". Weight 3½ oz. ¾" Scale

New 4-gun Navy fighter. Model will rise from land or water in few feet. Construction set contains fuselage and pontoon formers, wing ribs, tips, etc., printed on balsa, a 3⅜" turned cowl front, 2 instrument boards, colored insignia, lettering, windshields, 9" carved scale flying prop shown, 3 oz. silver paint, 1 oz. cement, ½ oz. black, 2 oz. glue, ready cut wheel pants, strong 2" aluminum wheels, 12 feet of rubber, and large 33"x44" drawing of land and sea plane. This is a sensational model and only one of its type in the world.
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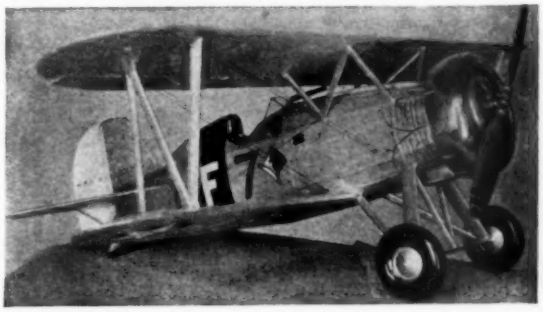

22½" Span. Length 14½". Weight 2½ oz. Color, Silver and Yellow

This is the finest equipped Boeing, F4B4 model in the world. New improved model exclusively equipped with new 3¼" special aluminum streamline tapered cowl ring, 9 cylinder celluloid motor with aluminum ventilator front, 8" carved varnished propeller, printed out balsa wood parts, silver dope, paper cement, glue, formed wire parts, celluloid wheels, tail wheel, U. S. Navy lettering, colored insignia, and ⅜" scale drawing. **Construction Set complete, postpaid..... $2.95**

NEW NORTHROP FT1 NAVY FIGHTER

22" Span. Length 15". Weight 2½ oz. ¾" Scale

A beautiful flying model of the latest Northrop 280 m.p.h. fighter. Set contains 3" turned motor front, 8" carved propeller, insignia, silver, black and clear dope, glue, all parts printed on balsa, full scale drawing, and all parts to build as shown.
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27½" Span. Weight 3½ oz. Color, Silver, Blue. ½" Scale

Model is fully detailed with authentic wing rib and body stringer spacing. Every air-minded boy will want this powerful-looking model. Motor power is run through the fuselage and is concealed—a special exclusive feature.

Set contains 2 standard steel type carved wood propellers, 16' rubber, star and rudder insignia, all parts printed on balsa, 2 turned balsa motor fronts, balsa air wheels, silver dope, black, glue, full size scale drawing, and all parts to build. **Construction Set complete, postpaid..... $2.95**

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XUM

Altimeters

(*Continued from page 38*)

level and the other at the flight level. The average of these two temperatures gives approximately the mean temperature of the air column.

The correction can then be obtained from published tables, or as is often preferred, the entire computation can be made on a computer such as has been designed for the purpose. Final, in the list of major deficiencies attached to the instrument is the fact that it is not "self-contained" when used in making a landing. That is, knowledge of the atmospheric pressure at the landing field level just previous to landing is necessary and must be secured by radio or other means. Naturally, if the pilot is landing at an airport with modern facilities, this problem is of little significance.

Quoting Dr. Brombacher, "The barometric type altimeter is an aneroid barometer graduated to indicate altitude in accordance with the altitude-pressure-temperature relation which defines the standard atmosphere. A single standard known as the United States Standard Atmosphere is now used for aeronautic purposes.

"Altimeters may be divided into two classes, solely on the basis of their sensitivity, into ordinary instruments and sensitive altimeters. In ordinary altimeters the sensitivity in general does not exceed one revolution of the pointer for each 10,000 feet. In the sensitive type the pointer makes one revolution per 1,000 feet."

The sensitive aneroid altimeter is generally employed in blind flying since this instrument also accomplishes maintenance of level flight as ordinarily understood, by indicating actual pressure level in terms of altitude. Level flight, with reasonable tolerances, is essential in blind flying, not with reference to distance above the earth's surface, but at a level of constant air pressure, that is, along an isobar.

In construction, the pressure-sensitive element of this altimeter consists of three evacuated diaphragm capsules. These are free to expand along their principal axis as the air pressure is reduced. The element is attached to a mounting plate at the center of the rear capsule and to a multiplying mechanism at the center of the front capsule. As the capsules deflect with change in pressure, a lever rotates a bell crank and sector.

A pointer shaft is rotated through gears, at a rate of one revolution for each 1,000 feet change in altitude. The pointer shaft, on which a shorter pointer is mounted, is rotated through an additional gear-train at a rate of one revolution for each 10,000 feet.

A third and smaller pointer which indicates the full range of the instrument in one revolution is placed on the shaft. Back-lash is taken up by a hair-spring. A weight is used to balance the mechanism for the effect of changes in orientation of the instrument. The spring adds stiffness to the pressure element.

A bimetallic bar changes its curvature with temperature and thus causes a deflection in the same way as the pressure element. This deflection is so chosen as to compensate at one pressure for changes in the reading which would otherwise occur due to variance in the temperature of the instrument.

Because of the extreme sensitivity of the instrument, accuracy and smooth operation is obtained only by the use of gears cut to very fine tolerances and by close adjustment of the mechanism. It is obvious that the case of the altimeter must be air tight against this small differential pressure.

The instrument mechanism is installed in a standard bakelite case of the 2-3-4-inch dial size. The depth of the case proper is about 3⅝ inches. In numerous trials, instrument errors associated with the use of the sensitive-type aneroid altimeter do not ordinarily exceed 0.75 percent of its range (20,000 feet) when using the instrument to fly at a definite pressure level. These can be reduced to an uncertainty of 40 feet in landing at an airport if corrections are applied.

Altimeters of all types are equipped with adjustments which greatly facilitate their operation and usefulness and do much toward correcting numerous defects of the instruments. Uncertainty is reduced to a minimum thereby and greater ease in the art of blind flying and landing is accomplished.

In somewhat the same manner, the rate-of-climb indicator is utilized as an aid to indicate change of pressure level in automatic or blind flight and landing.

Various instrumental errors of an altimeter in measuring the altitude of an aircraft above the earth's surface have been classified into an important list: (1) scale errors, that is, failure of the instrument to indicate the altitude in the standard atmosphere when subjected to the pressure corresponding to that altitude; (2) friction and vibration errors; (3) secular errors or zero shift, meaning errors of atmospheric pressure; (4) position errors or changes in reading due to the effect of statically unbalanced parts when the altimeter is oriented about its principal horizontal axes; (5) temperature errors,—changes in the indication of the altimeter due solely to

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1/8x3/16 15 for 5c
1/8x1/4 10 for 5c
3/16x3/16...8, 5c
1/4x1/4 6 for 5c
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the variation in instrument temperature; (6) drift and recovery or subsequent indication of pressure changes; and (7) hysteresis and after effect, more correctly defined as the lag of an altimeter in the instance of plotting altitude increasing and decreasing against altitude itself.

It is evident that the first four errors of the group are readily determinable for each instrument and that corrections for them may be applied in flight.

Temperature error is indeterminate owing to the added inconvenience of measuring the temperature of the altimeter, but the construction of altimeters compensated for temperature at all altitudes offers no practical difficulties other than that of increased cost. The drift and hysteresis effects are also indeterminate since they both depend on time and the previous elastic history of the instrument.

In addition to instrumental errors, accuracy of altitude measurement is affected by more serious discrepancies inherent in the barometric method. Deviation of the temperature of the air column from that assumed in the standard atmosphere, change in the atmospheric pressure at the reference level or base and variation in the elevation of the earth's surface contribute to lack of precision and uncertainty in measuring altitude above the ground level. These difficulties are eliminated only by obtaining information from the ground, usually by radio, or other means.

In his report to the National Advisory Committee for Aeronautics, Dr. Brombacher stresses the fact that neither absolute nor aneroid altimeters actually indicate obstacles in the line of flight. Knowledge of the elevation of the highest mountain peaks, and allowance for variation in ground-level pressure, as indicated by the aneroid altimeter, enables the experienced pilot to compute the presence of known mountains while in flight and to escape encountering numerous obstacles such as towers, powerlines and chimneys while attempting a landing.

Occasionally airplanes have been flown into mountain-sides with disastrous results and these accidents mark the need of some adequate means of pointing out oncoming danger. Since no instrument of that type has been developed, computations are necessary, together with information from the ground in present-day blind flying and landing.

Despite various difficulties, however, successful progress in the direction of dependable air travel by means of automatically-controlled aircraft has become a reality.

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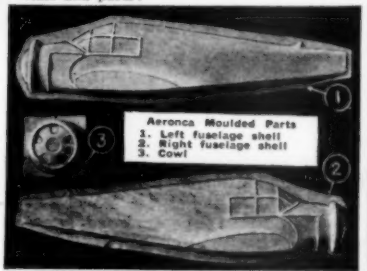

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Bombers

(*Continued from page* 16)

and helps to swing the large main rudder.

As the pilot pushes right rudder, for instance, the servo rudder moves to the left thus causing the main rudder to move right and thus greatly easing rudder pressure on the pedals. This system has been adopted by all major manufacturers of large planes. The performance figures on the YIB-9A were as follows: Top speed 186, cruising speed 160, service ceiling 20,000 feet. Construction was metal throughout.

Wings of tapered plan and form were of full cantilever construction, center section spars being of steel and outboard spars of dural. Ribs, formers and skin were of dural and alloy.

The all-metal monoplane continued to be in the front from this time on. The Ford Motor Company made a bomber known as the XB-906 as a modification of the popular Ford trimotor transport and using as its power plants three Pratt and Whitney Wasp engines. It differed from the usual Ford trimotor in having a gunner-bomber opening under the nose, a larger pilot's cabin, and rear gunners on top and bottom of fuselage. It could carry a bomb load of over 2,000 pounds at approximately 140 miles an hour for 750 miles. It was never put into production.

In 1932 the first of the now famous Martin bombers appeared, the XB-907, later to become known as the XB-10. This ship amazed military minds in this country as well as abroad because of its amazing speed and agility. This ship was perhaps the first bomber in the history of military aviation to actually pass pursuit ships in formation flying. Construction of the Martin was of a new type.

A restrained shell, all metal fuselage with corrugated top and bottom and smooth metal sides, was built up to give a very strong body with almost perfect streamlining and light weight its main attributes. The fuselage was of an elliptical cross-section, being built in three main units, as follows: (1) nose piece forward of front wing spar, (2) central portion built integrally with the wing center section and housing the bomb racks, etc., (3) the tail section aft of the wing.

The wings showed a unique method of construction in that they were of all metal construction from leading edge to rear spar and from rear spar to trailing edge were of metal framework fabric covered. As the XB-907 showed great promise as a fine bomber the Air Corps ordered one XB-10 type of same general type as the XB-907, but having in place of the usual open cockpit gun turret in nose with Scarff ring mount, a new innovation in the form of a "cage" turret that fully protected the gunner at all times.

After exhaustive tests the XB-10 was declared to be without a peer and an order was placed with the Martin Company for 15 of the YB-10 type ships. These again differed but slightly from their forerunners and had covered cockpits for gunner in both nose and tail and used the new Wright "Cyclone R-1820-17" engines of 670 horsepower each. Land-gear struts were modified as well, the YB-10 having a half-fork shock unit in place of the usual "Y" type.

Streamlined wheels and tires of 45 inches diameter were fitted as standard equipment. Landing gear retraction was accomplished through cables wound around an electrically operated drum, and provided with auxiliary manual control as well, which slid the rear drag strut along a track to the rear, thus pulling the wheels up behind the engine nacelle into a large well.

Crew consisted of 4 or 5 men made up of (1) bomber-gunner in nose turret, (2) pilot, (3) radio operator-navigator, (4) rear gunner. The rear cockpit can also be fitted with dual controls so that a co-pilot can be carried on long flights. A fifth man, such as squadron commander, etc., can be accommodated amidships in the radio-navigation compartment.

The bomb racks were entirely enclosed in the fuselage and provision was made for dropping these "eggs" through a large clam-shell door in the belly of the ship. The bomb bay could also be fitted with extra gas tanks in emergency in which case external bomb racks were slung under the wings from fuselage to engine nacelle.

Top speed of the B-10 with normal fuel load and bombs was 196 miles per hour at sea level, 215 at 6,500 feet and 213 at 10,000 feet. Service ceiling was unusually high for a ship of this type, being over 25,000 feet with both engines or 10,600 feet with either engine out of commission. It could climb to 10,000 feet in 7 minutes and had a normal range of 1,400 miles at 170 miles per hour.

No information relative to the type B-11 bomber has been released by Air Corps officials.

The Martin B-12 and B-12A types were developed soon after the sensational B-10 and differed essentially only in engine installation. The B-12's

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were powered with Pratt and Whitney "Hornet R-1690-11" engines of 670 horsepower each, in place of the 670 horsepower Cyclones used previously. The B-12A differed from the B-12 only in having certain internal changes, new instruments, etc. Thirty-three of the types B-12 and B-12A were delivered to the Army. A standard .B-12A bomber was fitted with Edo floats and in test hops many world's records for speed and distance were broken. These ships have also been success ully operated on skis during winter maneuvers.

August 22, 1935 marked a new day in Air Corps bombing history, as it was on this day that competing airplanes in the Army's "Superbomber" competition had to be at Wright Field, Dayton, Ohio, to enter official tests. Most Air Corps competitions for a standard service type cause but little interest in the majority of the public, but this particular testing period proved to excite more interest than had ever been shown. Stories began to come forth in the press of the country about "super-goliaths," "mystery bombers," and the like, and soon the whole country knew of this competition.

As press rumors were in many cases greatly exaggerated, the Boeing Company asked permission to release certain data on their entry, a huge 4-engined monoplane. The Air Corps granted this release to the Boeing Company as they later did to Martin. The Douglas Bomber was the first to arrive at Wright Field for the tests, arriving many weeks in advance of the others.

This job is basically at least very similar to the successful DC-2 Transport, but has the wings mounted in the middle of the fuselage rather than under the body as is the case in the DC-2 Transport. The nose gunner's turret was of the fully enclosed "cage" type but lacked the small "nose" which was used on the Martin bombers B-10 and B-12. The rear turret on the fuselage top just aft of the wing was of a new type. When in actual fighting trim it snapped up and appeared much like a small hat atop the fuselage and provided a revolving turret that could fire forward as well as to the rear.

When in closed position the turret snapped down and the top smoothed in exactly with the contour of the fuselage top, thus cutting parasite drag to a minimum. Two Wright Cyclone engines of 750-800 horsepower each were mounted and were equipped with three-bladed constant-speed controllable propellers. The usual Douglas retractable landing gear which folds forward into the engine nacelle was used on the experimental model. It was this ship that won for the Douglas company an order for 90 bombers to be used as the new standard service type.

The Martin entry was, outwardly at least, much like the standard B-10 type now in use. However it boasted many improvements such as wing flaps, higher horsepower engines, etc. The fuselage was of slightly larger diameter than on former models and had a full cabin pilot's cockpit instead of the usual sliding cover formerly used. Top speed of this ship was said to be approximately 280 miles per hour.

The most sensational bomber of all in the competition was the Boeing "299" 4-engined monoplane. This ship, which was equipped with 4 Pratt and Whitney "Hornet" engines of 750 horsepower each, attained speeds far in excess of any ship of its size. On its delivery flight from Seattle to Dayton, Ohio, it averaged 233 miles per hour for the long flight, using only 5/8th available horsepower, truly a remarkable achievement. This huge craft had a wing span of over 105 feet, overall length of approximately 70 feet and stood over 15 feet high. The most unusual of its many new features were perhaps the "gun-blisters," new type turrets that provided a maximum firing range with a minimum of wind resistance. The nose turret was a new departure as well, in that it was so balanced that it kept the gunner in a perpendicular position in relation to the earth's surface at all times, no matter how much the ship banked.

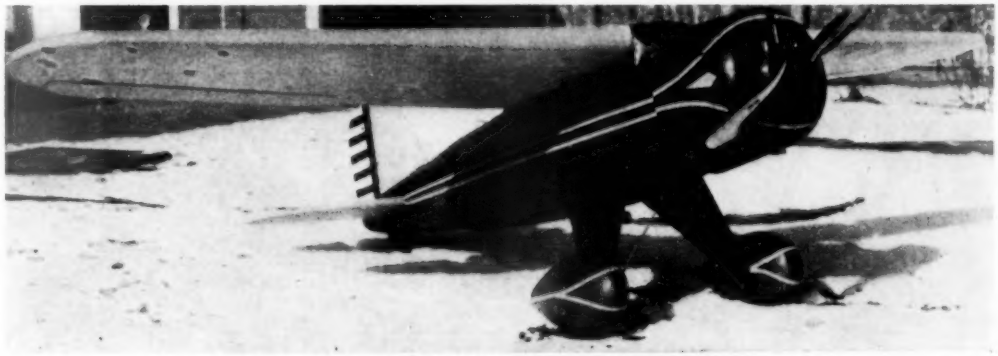
This would be of great aid in keeping a "bead" on enemy aircraft while in action. The bomb sight window was just aft of this nose gun and on the bottom of the fuselage. A large transport type cabin was provided with room for 4 men, consisting of pilot,

82″ LOCKHEED ARMY SPEED VEGA

1/5 H. P. GASOLINE MOTOR DRIVEN MODEL

Special De-Luxe Set, All Parts Ready Cut-Out. Easy to Build.

N E W



N E W

82″ Span. Length 54″. Color, Blue and Yellow. 2″ Scale.

WORLD'S FINEST EQUIPPED AND MOST PERFECT MOTOR DRIVEN SCALE MODEL

This is a special DeLuxe scale flying gas motor driven model of one of the latest series U. S. Army Lockheed Speed Vegas. It is one of the strongest possible to build and is specially designed to stand the strain of the gas motor. It is fairly light weight considering all the convenient and special features incorporated. As there are no struts or braces on this type plane it is less subject to damage than any other type, besides having the advantage of being perfectly streamlined, a high lift type wing which gives excellent stability in flight. The wing is 3″ deep at center section and stands 20″ from the ground.

The construction set contains all fuselage formers, wing ribs, tips, spars, leading edge, already cut to exact size and notched for stringers, spars, etc., also ready cut landing gear, struts, and wheel pants. One piece formed axle unit.

Some of the special features are a removable wing on bolts so model can be carried conveniently.

Two 4½″ M. & M. rubber tired pneumatic air wheels, 1¼″ rubber tired tail wheel, special axles, 5 yards of silk covering material, 9″ turned balsa cowl front, celluloid windshield, special motor switch, 10 ounces yellow dope paint, 8 oz. blue, 6 oz. paper cement, 8 oz. glue, 8 oz. clear dope. The gas motor is extra at $22.50 complete. 19″ propeller is extra at $2.75.

Set also contains all balsa stringers and many other balsa parts to complete model as shown. This model including gas motor weighs 5 pounds. It uses the 1/5 H. P., Brown Jr., gas motor. Model will take off from ground in about 25 feet landing, and take off speed of 15 M.P.H. Length of flight is governed by the amount of gasoline used in tank. ¼ oz. of gas will fly model over 2 miles.

Construction Set of model without motor, postpaid..... $25.00

Send 3c stamp for 8″ x 10″ beautifully illustrated catalog.

MINIATURE AIRCRAFT CORP., 83 Low Terrace, New Brighton, New York

co-pilot, navigator and one additional man such as squadron commander, etc.

All of the latest navigation aids were installed including robot-pilot, homing device, all radio aids, complete blind flying instruments, two-way radio telephone, and many others. To the rear of the pilot cabin and on top of the fuselage was a gun "blister" which housed a gunner firing to the rear, sides and above. Two more of these "blisters" were placed on either side of the fuselage just aft of the wing and above center line of the fuselage.

These turrets effectively covered the entire tail area and top and sides as well. Still another of these non-breakable glass turrets was on the belly of the ship just under the trailing edge of the wing and so placed to cover all enemy attacks from the bottom and rear.

A large two-piece clam-shell door folded out to display the bomb bay with provision for approximately 10,000 pounds of bombs and equipment. The landing gear was of the fold-forward retractable type and hinged forward into the engine nacelles. Flaps of usual type made landings of only 74 miles per hour possible.

All movable controls were of metal framework and fabric covered. A crew of from 7 to 10 men was normally carried. 1500 gallons of fuel provided a cruising range well in excess of any military bomber then in use. Top speed was approximately 270 miles per hour and cruising speed from 230 to 250 miles per hour. The first experimental model "299" bomber unfortunately crashed when undergoing tests in hands of Air Corps officers. Failure to unlock flight controls was said to have been the reason for this tragedy in which two men lost their lives.

An order for 13 of this type bomber has been awarded the Boeing Company and delivery is expected before 1937. An even larger Boeing is now under construction it has been said and it is expected to be even a greater sensation than the "299." Four engines of from 1,000 to 1,200 horsepower each are to power this new monster reports have it.

Through constant experimenting by the Air Corps and American manufacturers our bombing airplanes are today second to none, in not only performance, but also in reliability, as demonstrated by the formation flights of Martin Bombers in 1934 from Washington, D. C. to Alaska and return, and also by their frequent transcontinental flights from Army Post to Army Post.

END

Model Science

(*Continued from page* 45)

Sand the leading and trailing edges to shape. Next cut the airfoil section out of a piece of stiff cardboard and slip it over this frame till it is in the center section of the wing.

This procedure tilts the spars at the right angles for gluing the ribs. The ribs are cut out of 1/16 sheet balsa in the same manner in which you cut ribs for an indoor model. Now glue the ribs in place notching the leading and trailing edges to receive them. The ribs are spaced about 1 inch apart.

When the whole wing has dried, you can take the cardboard former off, and the ribs will hold the edges in position. Now cut the wing at the center, and give it the usual amount of dihedral. When covering the wing, be sure to cover the bottom first, using cement to fasten the paper to every rib.

This wing has the advantage of being able to flex in a strong wind without snapping the spars as a rigid wing would. The completed wing has a very pleasing appearance, being undoubtedly the most graceful and efficient model wing ever built.

EDITOR'S NOTE: *We solicit more articles of this type dealing with the rational design of models and the basic physical laws underlying their construction.*

Complete Kit for 64 in. Scale Model
REARWIN SPEEDSTER
Can Be Powered with Gas, "IMP," Air or Rubber Motor

Specially Designed by JOE OTT

64 in. Wing Span

Weight—18½ ounces

Gliding Ratio—6 to 1

Adjustable Angle of Incidence

Wings Removable for Convenient Carrying

Big Value Kit with Many Special Fittings

This remarkable Kit has been specially designed for International and offers the finest value obtainable in a popular priced Model Kit. This Model can be powered in four different ways:—(1) by any of the popular gas motors, (2) by the "IMP" Tornado Motors, (3) by Compressed Air Motor, and (4) by Rubber Motor. The Kit contains:—

3¼ in. Cork-Aluminum Balloon Tire Wheels.
12 in. Mahogany-finished "IMP" Paulownia Wood Propeller, fully finished.
Finished Nose Piece, with special attachment for Rubber Motors.
1½ in. "IMP" Propeller Shaft for Rubber Motors.
1¼ in. Cork-Aluminum Skid Wheel, Artist's Brush and Cement Brush.
4 oz. can of special Cement.
4 sheets, 24 x 36 in. Bamboo Fibre Covering Paper.
1 sheet each Red and Black Jap. Tissue for Decorating.
Complete Plan in full size on sheet 34 x 44 in. with details in accurate scale.
24 Ribs Printed on Soft Balsa sheets.
Front and Rear Spars and Trailing Edges of Medium Texture Balsa.
Leading Edges and Wing Struts of Hard Balsa.
Pants Sides fully shaped from Medium Balsa, with Cores fully shaped from Soft Balsa.
Fuselage Strips of Medium and Hard Balsa.
Special Pine Wood for Wing Braces.
6 x 12 in. Sheet Cellophane.
Set of Landing Gear Wires (Piano Wire).
Soft Metal for Hinge Straps.
Bolts and Nuts. Metal Lugs for Clamps.

Complete Kit Only $5.00
(Plus 25c Postage)
(See special offer below)

Power Your Model with the "IMP" S-2 TORNADO MOTOR

Easily installed in the Rearwin Speedster, or other type Model. The simplest, safest, most reliable and lowest cost power unit for any Model. Starts instantly, runs on AC:CO Gas generated by the "IMP" Generator; safe, economical. Will also run on compressed air.

Model S-2 "IMP" Tornado Motor; two cylinder. Weight 2½ oz. Flies Models 3 to 6 ft. size. Complete with Generator, Feed Line and Safety Clip.....$5.00
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Special Offer

Special Rearwin Speedster Model Kit and "IMP" S-2 Tornado Motor sent fully prepaid for.....$10.00
(Canada and Foreign) Kit alone.....$5.50
Motor alone 5.50
Kit and Motor together..... 11.00

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CENTRAL CAMERA CO., Est. 1899, 230S. Wabash, Dept. PA-11, Chicago

Swanee Taylor

(*Continued from page 27*)

match the competition's speed. Nor can I give you an answer as to how he feels when his clipped and souped-up models smack the ground due to structural failure or stinking spinning characteristics. However, we can rest assured, you and I, Max, that he'll get his just desserts sooner or later. They always pay off in this business—but in full! So don't let's worry about isolated cases.

Now about a pilot stalling close to the ground. But before going into this, Max, I simply mustn't sign off without emphasizing that nobody but you has grown argumentative about the little Hammond ship. It looks good and reports on it are extremely favorable. Without the slightest doubt it will serve a definite, worthwhile service to man. What's more, it will make a lot of money. We are all for it and wish to high heaven it could sell somewhere in the general vicinity of $700. But it can't, despite all of the misleading (fraudulent?) publicity releases coming out of Washington. If you must know, it'll sell for just about five times seven hundred. Does that give you a better idea of the Ole Halfback's silly bosh? Okay, let's get along an' wipe up this little quarrel.

About pilot error, Max, I'm a little worried about you. Haven't you listened to all the preachment on this particular point? For years, now, everybody has been hammering on that point. Statistics show that practically every aircraft misadventure is due to pilot error; bad judgment leading the rest. And at the risk of seeming trite, old fellow, I'm going to point out that the manufacturers make the airplanes—not the men who fly them. Or, to use an old one, the builders can make everything foolproof except the nut that holds the wheel.

You are all right, Maxie me lad. You're on the right track. But your valves need re-seating; why don't you turn yourself in for a top-overhaul!

Wistful Wish . . .

Oh, how I wish that the air hostesses wouldn't wear those bricklayer shoes. A pretty, shapely girl shod in clodhoppers robs virile man of his masculinity and makes him wish that he had never been born.

END

Hagner Finder

(*Continued from page 24*)

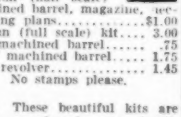
horizon circle and in a plane perpendicular to it. When the position finder is properly sighted, the observed altitude of any body can be read directly.

To use the Hagner instrument the observer needs only the Nautical Almanac and a clock giving Greenwich Civil Time. By virtue of its compactness and simplicity of operation the Hagner Position Finder takes the "mystery" out of navigation. It may be held in one hand during an observation, leaving the other free to make adjustments, or it may be placed on a gimbal for operation.

The device was invented by Fred C. Hagner of San Antonio, Texas, on the basis of personal experience in navigation while pleasure cruising in the Gulf of Mexico. Its adaptability to aerial navigation because of the speed with which observations can be completed was quickly seen and a number of the devices have been delivered to the U. S. Army Air Corps by Fairchild for service use.

END

COLT 45 Cal. AUTOMATIC $1.00



Colt 45 Automatic pistol model kit $1.00

Thompson Sub Machine Gun (half scale) Construction kit with machined barrel, magazine, necessary hardware, and working plans.....$1.00
Thompson Sub Machine Gun (full scale) kit.... 3.00
Savage cal. 32 automatic, machined barrel..... .75
Luger 9 M/M auto, with 4" machined barrel..... 1.75
Colt single action Frontier revolver..... 1.45
Send postpaid in U. S. A. No stamps please. Checks 15c extra.

● **F R E E !** ●

25 cal. Colt Automatic regular 50c kit free with every order of $2.00 or more.

These beautiful kits are complete in every detail, made of the best basswood. All parts are cut to shape and require only a short time to finish.

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1/32x1/16 .....10c
1/16x1/16 .....10c
1/16x3/32 .....18c
1/16x1/8 .....19c
1/16x3/16 .....24c
1/16x1/4 .....26c
1/6x1/2 .....60c
3/32x3/32 .....24c
1/8x1/8 .....29c
1/8x3/16 .....48c
1/8x1/4 .....52c
3/16x3/16 .....65c
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1/4x1/2 .....$1.50
1/2x1/2 .....2.15

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Scale craft flyer plans with movable controls: Post-Rogers Lockheed or the Monocoupe, $1.50 per doz. or $9.00 per hundred.

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1/32x2 ....10 for 14c
1/16x2 ....10 for 17c
3/32x2 ....10 for 20c
1/8x2 ....10 for 22c
3/16x2 ....10 for 31c
1/4x2 ....10 for 40c
½x2 ....10 for 75c

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1x1½, each 9c
1x2, each 13c
1x3, each 20c
1x6, each 35c
1½x1½, each 25c
2x2, each 25c
2x3, each 35c
2x4, each 45c
2x6, each 60c
3x6, each $1.25

COLORLESS CEMENT

1-oz. bots., ½ doz.23c
2-oz. bots., ½ doz.40c
4-oz. bots., ½ doz.70c
1 pt., each.....45c
1 qt., each.....75c
1 gallon, each..$2.00

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1-oz. bots., ½ doz.23c
2-oz. bots., ½ doz.40c
4-oz. bots., ½ doz.70c
1 pt., each.....40c
1 qt., each.....65c
1 gal., each....$1.75
Thinner same price as clear dope.

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White, per doz....12c
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All colors.
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For a short time only, we have cut our prices on die-cast parts. We are doing this for the sole purpose of acquainting new customers and friends with our products. We feel sure that once these friends get to know the DIAMOND quality, they will stick by us forever. Time and again, dealers have written us commending us on our services, prices, and quality. You, too, can feel the utmost in security if you deal with a reliable supply house.
Don't hesitate. Order NOW while prices are lowest.

STANDARD PITCH BALSA PROPELLER BLOCKS Per Dozen

½x¾x5 ..... 5c
½x¾x6 ..... 6c
¾x1x7 ..... 14c
¾x1x8 ..... 18c
¾x1x9 ..... 25c
¾x1¼x10 ..... 30c
¾x1¼x12 ..... 35c
1x1½x12 ..... 40c
1x1½x15 ..... 55c

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1/16 sq. x 14, 1 gross for 10c
1/16x¾x11, 1 doz. for 5c

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3/32 or ⅛ dia., 50 ft. for 20c

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Closed or Open

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2" dia., 3 for..35c
2½" dia., 3 for..43
3" dia., 3 for..55c
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Per 225' skein
1/32 sq. 25c
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3/32 flat 35c
1/8 flat 40c
3/16 flat 70c
1 lb., any size..$1.00

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SHEET CELLULOID

(Transparent)
12½x16, each 19c
6x8, doz 65c

INSIGNIA SHEET

12 pr. & rudder and tail markings with gummed back. Doz., 36c; 100, $1.75

DUMMY RADIAL ENGINES

(Celluloid 9 cylinders)
1½" dia., ½ doz. for 80c
2" dia., 3 for....65c
3" dia., 3 for....85c

CELLULOID MOTOR AND DRAG RING COMBINED

1½" dia., 3 for..40c
3" dia., 3 for....75c

NOSEPLUGS, HARDWOOD

1 doz. 5c
100 .....90c

CELLULOID WHEELS

¾" dia., per doz.24c
1" dia., per doz.25c
1½" dia., per doz.35c
1¾" dia., per doz.60c

BALSA BALLOON WHEELS

(Machine Turned)
½" dia., per doz. 9c
¾" dia., per doz.11c
1" dia., per doz.14c
1½" dia., per doz.19c
1⅞" dia., per doz.38c
3" dia., per doz.85c

BIRCH WHEELS LIGHT AND STRONG

½".....per doz. 5c
¾".....per doz. 6c
1".....per doz. 8c
1½".....per doz. 10c
1⅞".....per doz. 15c

BRASS BUSHINGS OR EYELETS

Per 100
1/16 diam. 12c
3/32 diam. 15c
⅛ diam. 18c

THRUST BEARINGS (Hard Steel)

Small, per dozen. 6c
Small, per gross..55c
Large, per dozen. 7c
Large, per gross. 70c

WASHERS PER 100

⅛ brass O. D.....5c
¼ copper O. D....5c

WIRE PER 100 FT. (Straight Lengths)

No. 6 .....15c
No. 8 .....18c
No. 10 .....20c
No. 12 .....23c
No. 14 .....26c

SHEET ALUMINUM Per 5 ft.

.002 thick 35c
.005 thick 50c
.010 thick 75c

ALUMINUM TUBING

(Special 1/100" wall)
1/16 O.D., 5 ft...30c
3/32 O.D., 5 ft...32c
1/8 O.D., 5 ft...32c
3/16 O.D., 5 ft...40c
1/4 O.D., 5 ft....45c

COLORED DOPE

White, yellow, orange, blue, red, green, olive, drab, black, silver, gold or gray.

1-oz. bottles, per ½ doz. 30c
2-oz. bottles, per ½ doz. 55c
4-oz. bottles, per ½ doz. $1.00
1 pt. each.....50c
1 qt. each.....85c
1 gallon, each..$2.25

SANDPAPER

5 Pieces to the Pack
Per doz. pkgs....25c

HIGH GLOSS

To shine up colored models.

1-oz. bottles, per ½ doz.....30c
2-oz. bottles, per ½ doz.....55c
4-oz. bottles, ½ doz. $1.00

CELLULOID PANTS

For ⅝" or 1" wheels, ½ doz..50c
For 1⅛" or 1⅞" wheels, ½ doz..75c

⅜ FINISHED BALSA WHEEL PANTS

Ready for final sanding

To fit: 6 pr.
½" wheels 36c
⅝" wheels 36c
1" wheels 36c
1⅛" wheels 54c
1⅞" wheels 54c

PROP SHAFTS (Hard Steel)

One size fits all models
Per dozen 10c
Per gross 75c

REAR HOOKS (Hard Steel)

One size fits all models
Per dozen 10c
Per gross 75c

DIE-CAST BOMBS

¾" long, 3 for...7c
1¼" long, 3 for..17c
3" long, 3 for..30c

PURSUIT or SWIVEL MACHINE GUNS (DIE CAST)

⅝" long, 3 for...6c
1¼" long, 3 for..11c
1¾" long, 3 for..16c

2-BLADED PROPS (DIE CAST)

1½" long, 3 for..16c
2½" long, 3 for..22c
3½" long, 3 for..26c
4½" long, 3 for..31c

3-BLADED PROPS (DIE CAST)

1½" long, 3 for..20c
2½" long, 3 for..26c
3½" long, 3 for..31c
4½" long, 3 for..41c

DIE-CAST WING AND TAIL LIGHTS

3 Pcs. to a Set
For 12" model, 3 sets 18c
For 15" model, 3 sets 25c
For 24" model, 3 sets 35c

MODEL PINS

Per doz. pkgs....35c

MACHINE CUT PROPS

5".....per doz. 22c
6".....per doz. 25c
7".....per doz. 35c
8".....per doz. 38c
9".....per doz. 40c
10".....per doz. 50c
12".....per doz. 60c

WOOD VENEER

(For scale model work)
20"x30", 3 sheets for 25c

GENUINE SUPER-FINE TISSUE

(Cover your champion endurance ships with this paper.)
18x24, per doz...50c

ALUMINUM LEAF

.0003 of an inch thick
3½" wide, 100 ft. for 35c

FRESH RUBBER A GRADE

3/32 flat, skein 250 ft. 20c
⅛ flat, skein 250 ft. 25c

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A Big Bonus for a Limited Time Only!

With each order for $2.50 or more of supplies we give free skein of para rubber; regular wholesale price 40c; retail value $1.40 FREE! With each order for $5.00 or more of supplies we give Free—1 skein of para rubber and 2 dozen large Insignia sheets. Wholesale price $1.17; retail value about $4.00.

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DIAMOND
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Air Mail

(*Continued from page 42*)

terested in knowing that this first air mail service also brought about the first anti-aircraft artillery. The Prussians, dismayed at seeing the balloons floating serenely overhead, hurriedly ordered the Krupps to build "archies" to shoot down the bulbous messengers of the wind. However, like the cavalry, used to chase the balloons without success, as well as the hawks, trained to intercept the homing pigeons, the anti-aircraft guns bombed away in utter futility until the starved city finally fell.

Early Flights

(*Continued from page 26*)

While the army was engaged in flying across the Channel, a Royal Naval Air Service Squadron crossed the same day. This unit was composed of seaplanes, under the command of Flight-Lieutenant E. T. R. Chambers. Arriving at Ostend on August 13, 1914, they established a temporary base from which they operated while the expeditionary force was crossing to France. On August 22nd, this squadron returned to England.

It is right here that the author desires to clarify something. The first crossing has very often been attributed to Commander C. R. Samson's naval landplane squadron from Eastchurch. This squadron in question did not fly from that station to Ostend until August 27th, 1914. As that unit did some admirable work upon its arrival, it is not the intention to belittle it but rather to give credit where it is due. Samson's squadron consisted of three B.E.2's, two Sopwiths, two Bleriots, one Henri Farman, one Bristol and one Short, the latter having wheels substituted for its floats.

Once at Ostend, Samson's squadron cooperated with the Marine Brigade carrying out daily reconnaissance until August 28th, when they had to withdraw from that place before the German advance. The next move was to Dunkirk where they were given some armored cars in which they achieved considerable fame as ground fighters on the days they could not fly. From there they moved to Antwerp, staying until October 3rd, whence it became necessary to retire from that place. They then moved up to Ypres and Poperinghe.

With the decision to establish a permanent naval air station at Dunkirk, the British decided to dispatch a squadron of seaplanes there. This unit, under the command of Squadron Commander J. W. Seddon, arrived on October 30th, and was the ninth British squadron to fly across the English Channel in 1914. Previous to the arrival of this unit another naval squadron, under the command of Commander Spenser Grey, had established a base at Antwerp but abandoned it on October 8th, when the town was evacuated.

The Antwerp base had been established with the primary object of carrying out their attacks against the German Zeppelin sheds to hinder raids on England. When it was foreseen that the Antwerp base would have to be abandoned, it was decided to carry out the attacks on Dusseldorf and Cologne that same day.

Consequently, Commander Grey and Flight Lieutenant Marix each took off

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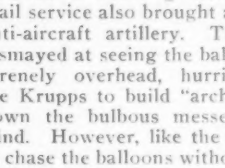

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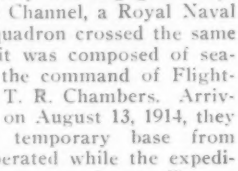

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1/8 x1/4 ..10 for .05
1/8 x3/8 ..8 for .05
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3/16" O.D. per ft.10c
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in a Sopwith Tabloid armed with four 20-pound bombs. Both reached their objectives accordingly. Squadron Commander Grey got over Cologne, but due to the thick fog was unable to find the huge hangar. Flight Lieutenant Marix was more successful, not only in finding the shed but in destroying the Zeppelin Z-9 which was in it.

With further plans evolved to carry out a raid on the Zeppelin factory and hangars at Friedrichshafen, permission was received from the French to use the Belfort aerodrome. While this was being arranged a squadron of four 80-horsepower Avros was gathered under Squadron Commander E. F. Briggs.

On November 21st, with an improvement in the weather, the raid was carried out and a large amount of damage was done to the sheds and the gas works of the Zeppelin plant was blown up. Only one thing marred the complete success of the expedition and that was the failure of Commander Briggs to return. While over Friedrichshafen, the gasoline tank of his machine was punctured in several places by machine gun bullets and, wounded, he was forced to land and was taken prisoner.

In reviewing these aerial activities which took place during 1914, consideration must be given to the fact that aviation was only in the pioneer stages. To take planes that were scarcely stable enough for exhibition stunt flying and adapt them to military service was a heroic accomplishment. END

Airy Chat

(*Continued from page 12*)

unable to give our readers much help on this subject at the present time.

However, we are just on the brink of performing some experimental work along this line, and if our idea works out, will publish a full account of the equipment with notes for its construction. This is really a hard problem to solve because of the weight limitations placed on the apparatus, hence we cannot promise an early solution of the matter. Wait and hope.

* * *

THE ability to control a gas driven model from the ground like a robot plane, will mean much to the gas model constructor. It will eliminate all of the running and chasing that has been an essential feature of gas model flying up to date and will therefore prolong the life of the shoes and auto tires.

* * *

MANY readers have written to us about the well liked "What Our Readers Are Building" department that was temporarily discontinued several months ago.

This department was suspended because of certain changes taking place in the makeup of the magazine at that time, but we will assure anxious readers that it will be restored at an early date. This has proved to be a popular department for nearly all our readers and has been a very interesting one for the editors as well as the readers. It demonstrates what can be accomplished in aviation with only a limited amount of capital.

* * *

LAST year, we believed that the transatlantic fad had died out, but this year sees a full revival of this quaint custom. The funny part of the thing is that they did not do half as well this year, in spite of the improved instruments, as the pioneer ocean flyers did several years ago with scarcely any navigational instruments at all.

* * *

WE are strongly in favor of a Department of Air in this country which will be the sole and undisputed authority in aviation. To be thoroughly effective, it must be entirely independent of other government bureaus and should be in charge of navy and army aviation as well as private and commercial flying. And—needless to say—should be independent of political connections, if that is possible.

* * *

IT is with regret that we announce the omission of Mr. Roddy's "High-Lights and Side-Lights" which has greatly interested our readers. Because of Mr. Roddy's poor health, he will be unable to do any writing, at least for some time to come.

* * *

Well, we're bumping into the ads again. So long.—J. B. R.

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Barnstorming

(Continued from page 32)

little girl called Marie who'd be waiting for him, and his bonus of six hundred dollars for the season.

"Pope," knowing the generosity and carelessness of the average barnstorming pilot with his money, had wisely arranged in his contract with his pilots to hold out 2½ per cent. of his earned commissions to be paid out at the end of the season in a lump sum, provided the pilot had not damaged his craft during that time to an amount not over $25. Mack had been both very lucky and a little cautious and all season, had not put even a scratch on the big Curtiss R.

As he was debating what he would do about the bonus, the dim glow of Hackensack lights, reflected in the overcast above, told him that he was not more than fifteen minutes' from his home airport. By straining his eyes in the inky blackness of the night he thought he was catching the slow but regular flashes of the Fokker beacon light. That spelled rest, recreation and some well earned binging about after one of the hardest and most successful seasons the Circus had.

Suddenly, without a single warning, his beautifully built castles began to crumble as he heard a choking cough and a splutter from his motor. The old crates had never had any gas gauges and consequently the pilots would never depend on them if there had been any.

Mack nosed his ship down slightly and the skip stopped, but only for a few seconds. Then the big Liberty began coughing violently on both banks, shaking the ship as though King Kong had decided to use it for a toy. After a few more choking, irregular explosions, Mack's motor died completely and everything was still around him.

You know, that funny sick silence that comes unexpectedly and you begin counting ghosts over your left shoulder? Well, when that happens today the pilot merely reaches down for the release rings of his two expensive magnesium flares and releases them both, one after another.

Such a magnesium flare, once released, opens and automatically ignites the magnesium cartridge. The light is so powerful that it clears up everything below within a radius of 5,000 feet and the pilot brings down his ship to the best spot in the lighted area.

Neither Mack nor any other Gates pilot, however, carried any light whatsoever on any of their night flights. Landings were accomplished on a prearranged spot by a mechanic lighting up the field by touching off a bucket of gasoline with a match. But right now, there was no one below expecting Mack and nobody to care except himself. He did what he could, strapped his safety belt on tighter as the old crate kept sinking rapidly towards the pitch black earth somewhere below him.

There was nothing to do but try and feel for the ground and hit it as slowly as possible. At least his suspense wasn't too long. His wheels hit something soft as he yanked back on the stick to make the tail go down. It leaped up and the wheels hit again and Mack felt himself jerked forward as his head hit the dash board and the big crate's wheels mired in the soft, plowed ground, flipped itself over backwards.

In its downward glide the doomed ship had barely missed hitting the farmer's silo and was noticed by his daughter. In another few moments the entire family had rushed to the overturned plane and, upon a closer examination by the light of the farmer's lantern, discovered that a human head was sticking out of the cockpit and was now resting in an inverted position just touching the ground between two deep furrows.

They shook the head of the unconscious pilot and when the latter opened his eyes, blinking wildly, the other members of the family lifted up the tail of the overturned crate sufficiently high enough to enable the dazed pilot, after releasing his belt, to fall out of the cockpit head first and disengage himself from the crack-up.

After surveying the unfortunate result, Mack silently picked up his black satchel and strode off in the darkness without so much as murmuring his thanks, let alone explaining why he

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picked on the farmer's back yard to crack-up.

For two days afterwards Mack's whereabouts were unknown to anyone but himself. Ivan Gates first heard about the crack-up when he read about it in the papers. But Mack, knowing too well that his bonus could hardly cover the crack-up, never bothered to explain. He had tossed away six hundred bucks, and let anybody try to alibi himself over that!

Soon thereafter, Clyde Pangborn and Lee Mason with the only two ships remaining on the road, returned to Teterboro and the final chapter of the original Gates Flying Circus was completed. Ivan Gates, realizing that the circus days were about to close forever, began looking about to go into the manufacturing end of aviation. He picked on Charles Day, the original designer of the J-1 Standard for his chief engineer, and that fall a new aircraft manufacturing concern was born and incorporated as the Gates-Day Aircraft Corporation.

This concern soon produced an open cockpit five-place biplane powered with the modern Wright J5 aircooled motor. A smaller ship, known as the Gates-Day Trainer was also produced in the abandoned silk factory now busily engaged to fill the incoming orders. Some engineering talent was grafted from the Sikorsky organization, George Davis, the advance man, became general sales manager and with Clyde Pangborn as vice-president and chief test pilot, the organization was neatly rounded out.

While this was going on back East, some of the remaining pilots decided to rebuild a few of the old crates and go South for the winter under the leadership of Bill Brooks. Four ships started out late in the fall and only two came back on wing early next spring. The ships were getting distinctly unsafe. Still, the all-time record was broken by Bill Brooks that winter when he carried 900 passengers in his ship in one day at a dollar a hop.

Another cute little trick of the winter was pulled by Bill when, with four passengers aboard, he lost his motor. The engine mounts had given way to constant landings, and the engine, propeller and engine bed literally flew right out of the nose of the old crate, leaving the ship and its pilot whipstalling at 1,500 feet from the ground.

Any other pilot in such an emergency would have most likely thrown up the sponge and grabbed on to a few new prayers, but not old Bill. As the completely unbalanced crate was first standing on its tail and then whipping into a spin, Bill manipulated his stick and rudder so as to recover from the spin, only to start falling immediately into a spin on the other side.

From the ground the crowd saw the motor fall and bury itself in the ground while the pilot was desperately trying to save the lives of his passengers and himself. He brought his ship down in what looked like a falling leaf maneuver. Just before it hit the ground, the ship recovered its nose, Brooks immediately kicked full right rudder and the ship whipped over into a right bank hitting the ground on wing tips.

The full shock of the fall was absorbed by the crumpled wings, saving the lives of all five occupants and Bill walked away from that one with only a scar across his forehead.

With new airlines springing up all over the country backed up by the powerful publicity of their press agents, the public, ever fickle, yet ever ready to try a new thing, turned its back on the old barnstormers and soon forgot the thrill of their amazing antics in the air.

Progress, inevitable as Time, had written the last chapter. With all its daring exploits and individual heroes, the Gates Flying Circus was grounded at last, its rickety old crates cracked up or unfit to fly, its pilots scattered or gone on their last flights.

What is left is but a memory of an old timer of a circus that carved out heartbreaking history.

END

Tornadoes

(*Continued from page 32*)

and the little whirls became truly devils, big enough to pick a man up and whip him to death in the twinkling of an eye. People ran to get out of their way. It was then that one broke loose from the fire and blew the little farm house to pieces.

Columns of flaming oil are not common enough to be a menace to aviators, nor anything more than rare curiosities, and common prudence would warn everyone to keep away from such places. These man made tornadoes, however, are matters of great scientific interest, because they reproduce in a small way what takes place on a nation-wide scale when a big tornado forms.

In order to have a tornado, we must have a mass of strongly heated air, about which blows a wind that is cooler and wetter.

The mass does not have to be air—for the same thing can be seen in the eddy of any building on a windy day, or even in the sound of wind howling about the eaves, for the howling note is the burble from many tiny tornadoes. But tall vertical buildings, even skyscrapers are puny compared with natural air masses for size.

The whirls generated by buildings and even mountains are never large, but those made by the interaction of hot and cold air masses make full sized storms. These oil fire tornadoes show that it might be possible to build tornadoes at will, if anyone should desire to have such Frankenstein monsters about.

END

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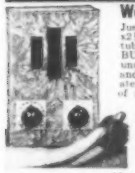

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XUM

Air Board

(Continued from page 30)

tion to the airplane such as ground transmission, special brakes for propellers, folding wings and other unavoidable devices diminish the performance and usefulness of the airplane or autogiro. Also while such a combination aircraft might be made safe in the air, it might be very fragile in congested traffic on the ground. Just imagine what would happen to a roadable airplane if hit even mildly by a truck!

Captain Depew summarized the situation by saying that Harold F. Pitcairn and his engineers were to be congratulated on their bold effort; that experts were people who had more reasons than any one else for saying that a thing could not be done; that while there were undoubtedly technical and other difficulties in the way of roadable aircraft, they were worthy of serious consideration and that attempts to develop such craft were entirely praiseworthy.

WHO OWNS THE AIR?

Mr. Hall propounded this curious question. The air is about the only thing that remains untaxed, and now the United States Circuit Court of Appeals has ruled that it is free and that no one can use it exclusively. We shall quote from an editorial in the Rochester Times Union:

"Sometime ago owners of property adjoining an airport contended that they owned the air up to 150 feet above their property and that airplanes had no right to fly through the air. So they sued for damages and trespass. The court held that the sky has no definite location and like the sea is incapable of private ownership. The owner of land owns as much of the air above it as he uses, but only so long as he uses it. All that lies beyond belongs to the world."

This means that we cannot prevent planes from flying above our houses or swirling over the golf course. Of course regulations as to minimum height of flight over congested cities, etc., give the lowly inhabitants of this earth more protection than would at first appear from this ruling of the Court of Appeals.

A TRANSATLANTIC AIR RACE.

In commemoration of the tenth anniversary of Colonel Lindbergh's flight from New York to Paris, the French Air Minister Pierre Cot has announced his decision to organize an international air derby from New York to Paris on May 21st (the exact day of the famous flight) in 1937. Only two details have been worked out so far. One is that the start will actually take place on May 21st, and the other is that airmen of all nations will be qualified to enter.

At first blush this appears to be a fitting memorial of Lindbergh's flight and a magnificent idea.

Members of the Board were not so sure that it was such a good idea.

The prize is to be a million francs, which translated means only $63,000. It is not possible to buy a China Clipper, worth say a quarter of a million with such a sum. The tendency would be therefore to employ relatively small single engined land planes, filled up to the gills with gasoline. The useful load to be carried would be nil. The winning pilot or crew would deliver a few letters or an engraved address to the Mayor of Paris, as its sole commercial load.

Some of the world's greatest pilots might end up by falling into the sea. All the painful effort of Pan American, Luft Hansa and the French airlines to convince the public that transatlantic flying was safe, sane and commercially possible would be robbed of effectiveness, because the public would again receive the impression that flying across the ocean was at best, sport, at worst, hazardous adventure.

The transatlantic flights achieved in recent years have either failed, with bad effects on the public's airmindedness; or have been successful and earned but a few lines on the back pages of the press. What at best would be gained by another flight across the Atlantic, when the NC4 had done the job way back in 1921?

This viewpoint is perhaps too gloomy and onesided. After all racing is practised in every sphere of locomotion. Why not in aviation which is the speediest of them all?

The Air Board discussions are vigorous, frank and quickly decisive, but here argument seemed to prolong itself without result.

Finally, Mrs. Gillies with rare common sense set everybody right. Granted that just a speed race would have little value, could not the rules be so framed as to make the event of real use to practical aviation? Instead of just a speed race, the contest might be one of precision and reliability. The contestants would stipulate their cruising speed, and time of arrival. They would be required to carry perfect safety equipment. They would receive points for their accuracy in judging the time required for the crossing. Other points would be given for useful load carried, etc. Cooperation would be secured with shipping lines who could be in constant communication with contestants by radio and other safety measures would be adopted.

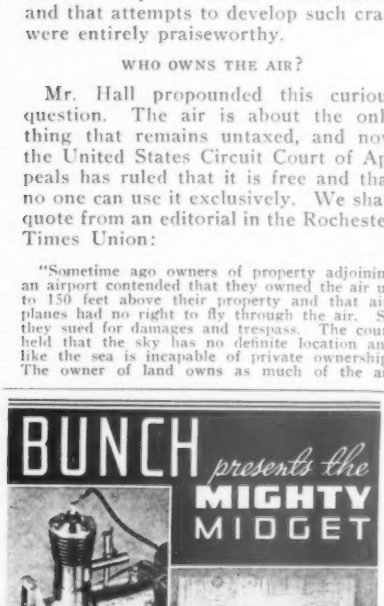
It was immediately felt by all members present that Mrs. Gillies alone was on the right track.

Mr. E. Burke Wilford amplified the proposal by suggesting that the planes would be restricted to twin-engined or multi-engined aircraft; that boats would be stationed every 500 miles along the course; that ample flotation gear, and radio to work after an emergency landing could be insisted upon. Mr. Wilford cited the annual yacht races to the Bermudas, a hazardous crossing for small boats. By means of wise regulations and safeguards these yacht races are at one and the same an exciting sporting event and yet a perfectly safe method of improving the seaworthiness of small sailing craft.

Finally a resolution was passed that the Chairman be required to write formally to the French Air Minister suggesting rules along the above general lines, and at the same time offering on behalf of the Air Board all the cooperation possible.

The gathering felt that with this last decision it had accomplished a good day's work.

END



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WPA

(*Continued from page 28*)

the airport consists of the cost of materials and the hiring of skilled labor. The community must post a certain amount of money to cover the cost of its share of the project. If, in certain rare instances, a community would recognizably prosper through the establishment of a local airport and have been unable to afford the project, WPA funds can be gotten for materials and even skilled labor. These cases, however, are few.

WPA administrators for each state mainly are responsible for the presence or lack of airports under construction. Though a few states' administrators are not air-minded and lack the ability to prepare for the future, the majority of state WPA officials favor and encourage the projects.

Illinois might be used as an example. As mentioned before, airports using WPA funds and labor must be publicly owned—municipal airports. Illinois has six municipal airports, all of them being improved through WPA and Bureau of Air Commerce efforts. Chicago's municipal airport, probably the world's busiest air terminal, has had WPA laborers resurfacing, enlarging and installing drainage systems for several months. Illinois' other five municipal airports are at Joliet, Galesburg, Bloomington (approved but not yet under way at this writing), Moline and Camp Grant.

These communities, determined to take advantage of the opportunity to put their much-used airports back in shape, made haste in meeting WPA requirements. Citizens of Moline, for instance, realize that in time of war the huge Rock Island arsenal there will need an airport both for protection and transportation of needed arms and for the training of military and naval pilots. This latter point is one that Illinois' deputy WPA administrator, Charles E. Miner, has kept foremost in his mind.

"Illinois, like the rest of the plains states in the midwest, is admirably suited for aeronautical purposes in case of war," Mr. Miner said. "Practically any Illinois corn field, for instance, can be landed on by student pilots receiving training. The already established airports in this state could immediately be turned into aviation bases."

END

Air Races

(*Continued from page 20*)

ord unequalled by any other transport line. . . . Jimmy Doolittle, a peer among pilots, and now connected with Shell gasoline, was an interested spectator. . . . Amelia Earhart, ladybird number one in these United States, was attired in her usual costume of brown slacks and shirt.

Mr. and Mrs. Benny Griffin were early arrivals at Mines airport every day. Benny is doing some mysterious work on a new Lockheed at the factory. Rumors say he's planning a stratosphere flight. . . . Peggy Salamon, blonde English aviatrix was in evidence. . . . Major Bill Long, official representative of the Texas Centennial and his bride were present. . . . Carl Squires, president of Lockheed Aircraft, addressed the crowd. . . . Ruth Chatterton, sponsor of the Ruth Chatterton Derby, and Kay Francis said Hello. . . . Ditto Jimmy Dunn and Eugene Vidal.

Bruce Cabot and Adrienne Ames were box holders . . . also Eddie Cantor and Lyle Talbot. Mary McCormick opened the races on Sunday by singing The Star Spangled Banner . . . afterwards she was hostess to some friends in her box.

We missed the famous army stunt team, "The Men on the Flying Trapeze," otherwise known as Lieutenants "Luke" Williamson, John "Mac" McDonald, Jr., and Major Claire Chennault. They have disbanded, Luke and Mac going to China to train airmen. General Westover, head of the army air corps, apologized to the spectators for not having an army stunt team. It will be a long time before the army will again have three such wonderful representatives.

The 79th Squadron from Shreveport, Louisiana, under the command of Captain Charles Kersey, performed beautiful formations in their highly supercharged pursuit ships. These ships attain their maximum speed at high altitudes. . . . The 17th Attack Group from March Field under the command of Lt. Colonel Carlyle Wash flew in some stunning tactical maneuvers, and the U. S. Army Air Corps sextet from Barksdale Field, Louisiana, under the command of Captain C. O. Pearcy did beautiful work. . . . Ditto the Marines from the Naval Air Station at San Diego under the command of Lt. Comm. C. D. Glover.

And so another National Air Race is over. The attendance averaged 60,000 people a day, and they waved their appreciation instead of applauding, because that is lost in the roar of airplane motors, to the dare-devil speed and stunt pilots at the 1936 National Air Races.

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2	131	Kling Rider	R. A. Kling	R. A. Kling	Lemont, Ill.	226.444	250.00
3	22	Elmendorf Sp.	David Elmendorf	David Elmendorf	Palms, Calif.	224.551	150.00
4	38	Howard DGA4	Ben C. Howard	Harold Neumann	Kansas City, Mo.	223.714	100.00
5	70	Rider	Homer T. Seale	Roger Don Rae	Alhambra, Calif.	218.155	50.00
6	33	Brown 32	Ernest Schoedsack	Marion McKeen	Inglewood, Calif.	217.305	....

*The fastest single lap of each plane during the race is taken as the official qualifying speed.

END

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WPA Projects

(*Continued from page 35*)

provements, about $2,000,000 is earmarked for the rehabilitation and extension of the Chicago municipal airport. WPA workers—several hundred of them—are now installing a main tile drainage system to carry storm waters from the field.

The drainage system, designed by the Chicago Board of Local Improvements, is considered up to the highest government standards in sound engineering by the Bureau of Air Commerce which exercised technical supervision over the work as well as over all WPA airport work throughout the state and country. This one phase of the project alone is said by air commerce engineers to improve the safety facilities of the field by nearly fifty percent.

One of the greatest problems confronting Chicago airport officials for years has been the inadequate size of the landing field and this has been given major consideration in mapping the improvement work. The present port is bounded by Cicero Avenue (east) and Laramie Avenue (west) and runs from 59th to 63rd Streets. Under the present expansion program the boundaries will be extended to 55th Street on the north and west to Central Avenue.

Work of improving these additional areas is next on the program of the WPA workers and now awaits the outcome of efforts to move the railroad tracks which now bisect the field parallel to 59th Street, arguments for which all interested parties contend will be successful.

Other works includes the rehabilitation of runways, grading and draining of the new extensions, construction of new "warming aprons," reconstruction of hangar approaches and improvement of the field lighting system. When completed, the present 160-acre airport will cover 640 acres of grounds.

While Chicago has been carrying forward its vast program, officials of Moline at the opposite side of the state have been equally alert. On the promise that the tri-cities of Moline, Rock Island and Davenport will be made a regular passenger and mail stop for the newest big transport planes operating to the west, Moline officials have put over 200 WPA workers to work doubling the capacity of its present airport, removing surrounding hazards such as fences, high lines and the like, and hope later to follow up this work with modernization of its hangars and administration building.

Comprising the largest grading job ever attempted in Rock Island County, the Moline project involves the moving and levelling of 400,000 cubic yards of dirt on which WPA workers are using everything from shovels and wheelbarrows to the largest power scrapers and elevating graders obtainable, with narrow gauge railways, tractors and trucks thrown in.

Moline citizens are already claiming the new field to be one of the finest in the country, pointing with pride to the 208 acre expanse which will soon have cross-runways 4,000 feet in length. The former field was 108 acres and not too level.

Using modern highway specifications, the runways at Moline will be hard surfaced to a width of 100 feet with shoulders of rolled gravel 50 feet wide and then tapered off to an overall width of 500 feet. When completed, the highest powered air transports, with perfect approaches, will be able to land or take off with ease in any kind of weather.

These accomplishments are actually well along toward completion, but they are only a part of the total planned achievement, according to city officials. Additional plans call for new boundary lights and a modern flood lighting system, modern drainage (which is being installed along with the grading operation) and an administration building which will house ticket offices.

At Galesburg, the municipal airport is being graded and drained and new modern runways are being installed. This work, started under the CWA, then carried forward by the Illinois Emergency Relief Commission, is now nearing completion under the WPA—all the while giving much needed employment at security wages, to many of the town's needy unemployed. Under the same former relief programs, Illinois airports were completed at Springfield, Quincy, Peoria, Kewanee and Dixon.

And air-minded city officials do not have a monopoly on the state's progress in airport development. At Rockford, the Illinois Military and Naval Department has taken a hand and is executing a WPA project for improvements at the Camp Grant airport, which, when completed, will be used as an emergency landing field, but chiefly as a training field for air corps cadets of the state's national guard forces.

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Meteorology

(*Continued from page* 40)

might be of value to other pilots subsequently scheduled to fly that particular route.

The reports are copied verbatim, on forms designed for the purpose, by operators at the ground stations; and the forms are then immediately posted for the attention of personnel who have supervision over the flight operations and for the information of pilots who are later to fly the routes.

Incidentally, the forms are prepared in duplicate and one copy is retained by the radio operator, enabling him to be in position to pass the aloft data on to other pilots in the area in cases where they did not hear the original reports. Each terminal station along the route receives and copies all of the airplane reports as transmitted between it and each of the adjacent terminals.

There are always at least two ground stations and in some cases, depending on the position of the plane, as many as five stations recording the data being transmitted. This provides each station with complete aloft information for the sectors into which planes are to be dispatched. The reports from selected flights are also regularly made available to the airport offices of the U. S. Weather Bureau for their information.

The value of the aloft reports increases in direct proportion to the number of scheduled trips flown. Where five to ten round trips are flown over a particular airway during each 24-hour period the airplane reports are then presented in a very satisfactory sequence and at no time are the latest reports over a very few hours old, usually only a few minutes old. Even greater advantage can be secured through the use of the airplane reports by clearing them through some central agency such as the U. S. Weather Bureau.

For several months the Weather Bureau airport offices at Portland, Salt Lake City and Oakland collected the reports as transmitted from the planes flying into those points with a view to improving their weather determinations. The supplementary information so provided made it possible for forecasting offices to analyze the existing situation more accurately and to improve on their forecasts.

Recently the U. S. Weather Bureau set up a procedure whereby the airplane reports from all air lines operating into a station could be cleared through the airport Weather Bureau offices, and information and forecasts relative to weather conditions at flying levels thereby made available for distribution from such offices. The Weather Bureau is to be complimented for their action in this case. It is undoubtedly a step in the right direction.

The systematic reporting of weather from airplanes in flight has also provided assistance along lines which may not be classed as being strictly meteorological. Through determining the temperature conditions encountered by planes previously over an airway it is an easy matter to route subsequent trips into levels where maximum passenger comfort may be enjoyed.

During periods of extreme temperature conditions on the ground it is frequently possible to route the planes into levels where the temperatures are moderate—without the necessity for exploring for such conditions. Similarly the reports on bumpiness make it practicable for the pilots to take advantage of the conditions encountered by pilots previously over the routes and by so doing fly the planes in the smoothest air.

The purpose of United Air Lines in involving as many personnel in the actual business of weather reporting is to take advantage of the maximum amount of weather information it is possible to accumulate. It is axiomatic that nobody can positively and consistently forecast weather in advance. It is possible, however, by taking advantage of every speck of current up-to-the-minute weather facts to make a reasonably good analysis of the trend of weather and from that a fairly accurate forecast in advance. The more weather information you have to analyze and on which to base this forecast, the more accurate the forecast will be.

One step in the direction of accumulating a maximum amount of weather information was taken last year by United Air Lines when it established a course of meteorology for its personnel under the direction of Howard Kastor, meteorologist for the Boeing School of Aeronautics, owned by United, and Ted Larsen, United's own meteorologist.

Six hundred and fifty "students"—pilots, dispatchers, radio operators and other ground personnel—have been studying these courses and as a result have vastly improved their knowledge and understanding of weather conditions. They are now taking more advanced training in weather and as a result instead of one meteorologist, United will soon have 650 qualified weather men.

United's theory in this regard is that by educating the men who are called upon to deal with weather in the trends and characteristics of weather, they will be better qualified to properly carry out their duties.

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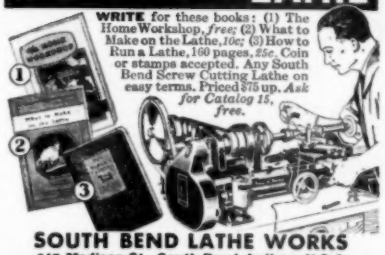

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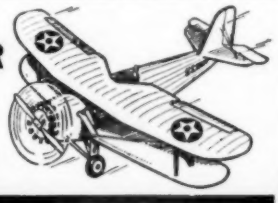

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Caudron-Renault Model

(*Continued from page 47*)

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